July 1948

Chemical Industries

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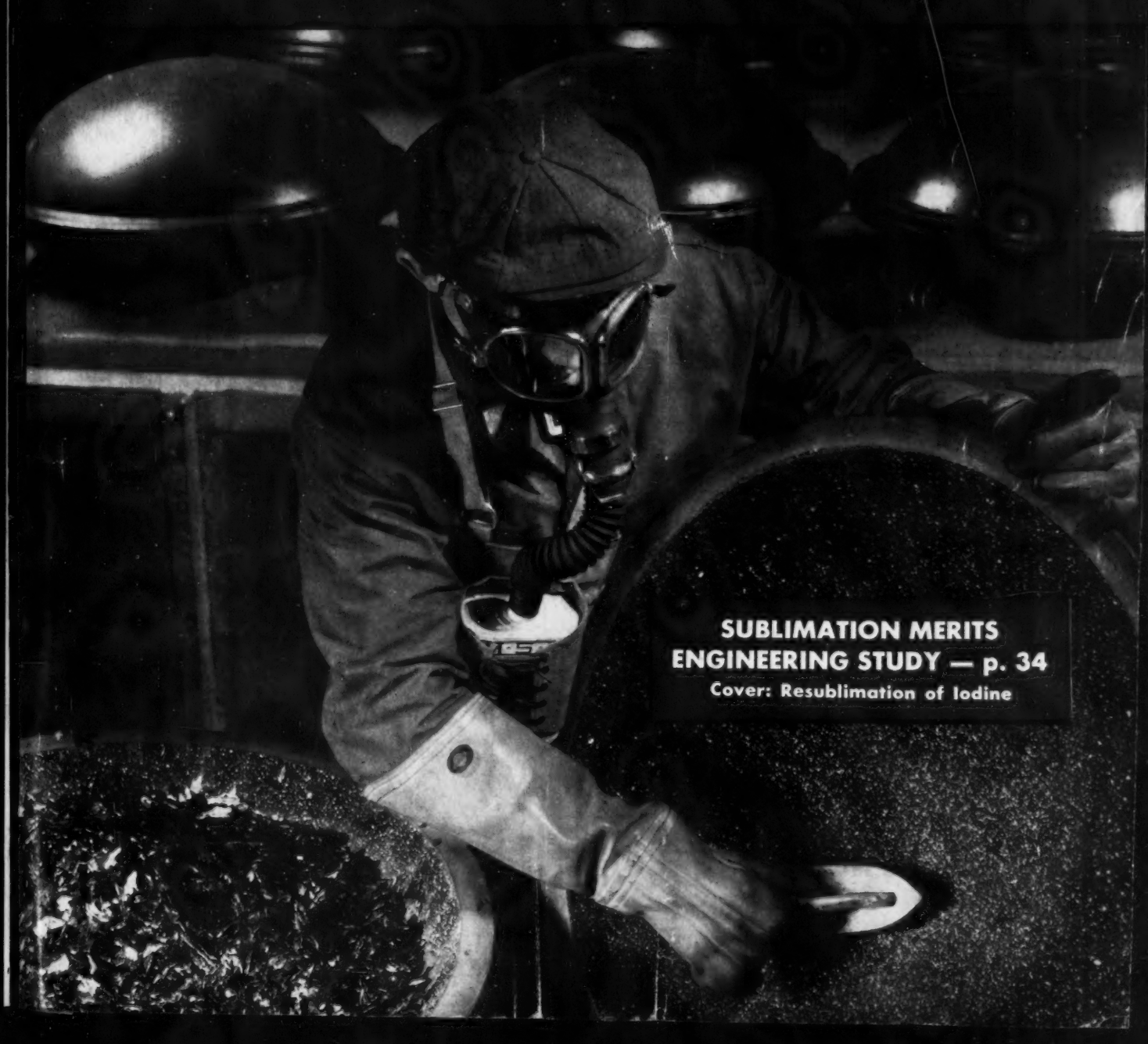

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Cover: Resublimation of Iodine

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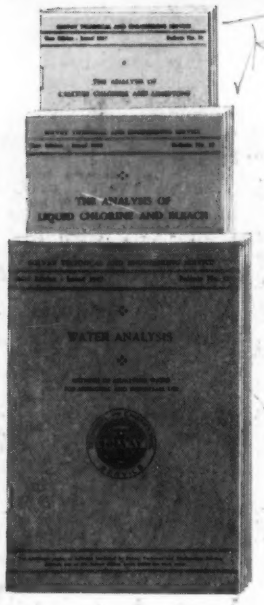

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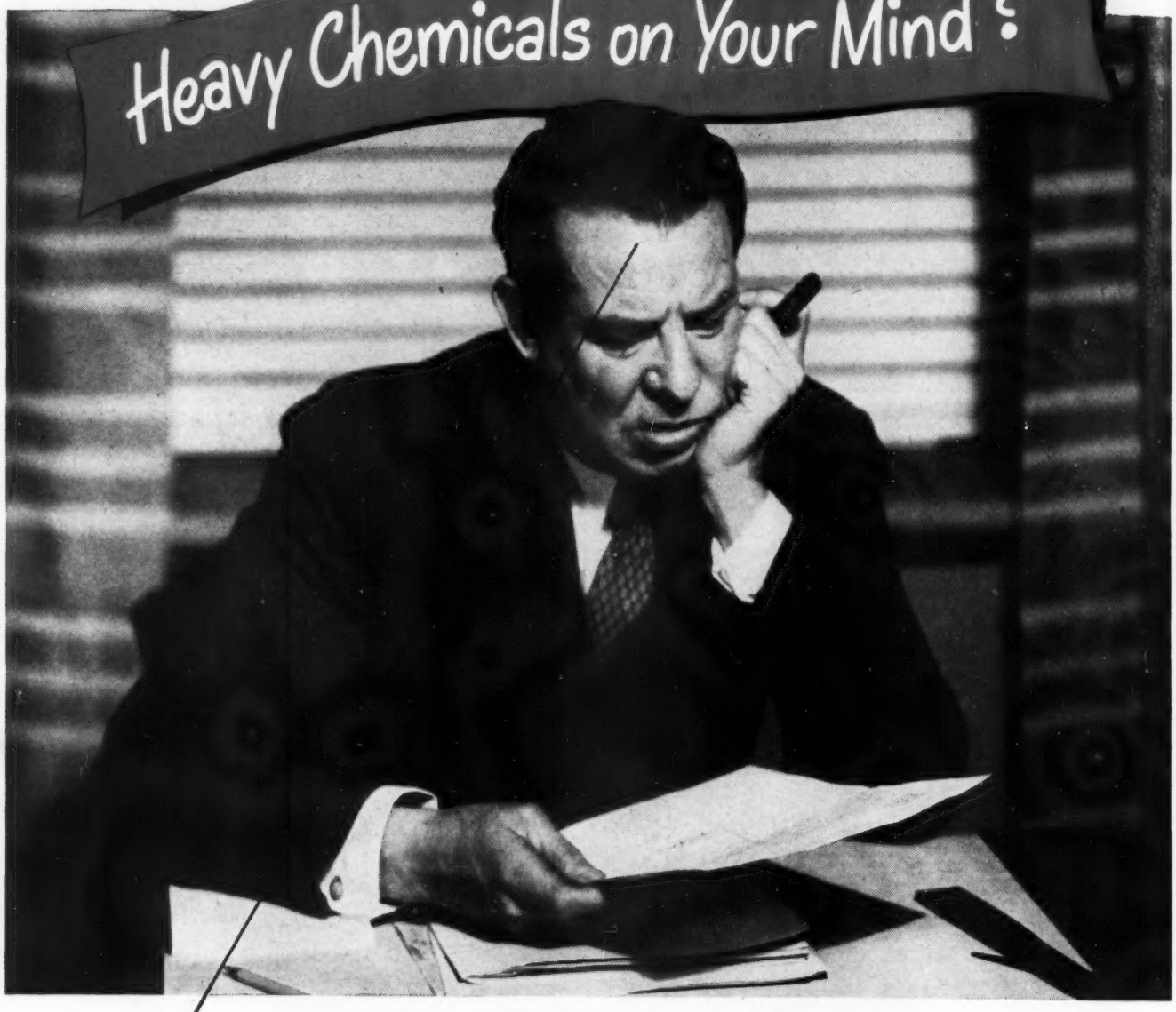

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Chemical Industries

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VOLUME 63—NUMBER 1 JULY, 1948

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THE READER WRITES

For Tailor-Made Detergents

To the Editor of Chemical Industries:

I enjoyed reading your article on detergents in the November isue. However, based on my experience in the textile and detergents fields, which incidentally numbers a good many years, I believe there are some points that should have been enlarged upon.

Ordinary soap plus an alkaline builder forms a very good detergent. The sodium or potassium salt of a fatty acid not only have both water and oil soluble groups present, but in addition the organic ions of soap in water form a complex which is so large it has colloidal properties. This latter enhances cleaning action and is a property not possessed by synthetic detergents.

Why, then, the rapid growth of the synthetic detergent industry? The reason is that synthetic detergents have been found to be a valuable additional tool for use where soaps are lacking in desirable properties, other than detergency, on the alkaline side.

The problem becomes even more complicated in the textile industry, where the detergent must be selected to give maximum efficiency for the process involved. The following, for instance, are all factors which enter into the picture: hardness of water; type of machine used; process method (whether boil-off, dyeing, or final wash); and type of fiber involved.

If both users and manufacturers of detergents would devote more effort to fitting the detergent to the process, this fundamental research would pay handsome dividends.

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Shellac, Aluminum Not Knot-Sealers

To the Editor of Chemical Industries:

Thank you for publishing information in your March issue, page 420, on Knot Sealer WP-578, which was developed in our laboratory.

As I continued to turn the pages of this issue, I came upon the article "Why Do Paint Jobs Go Wrong?" on page 540. This article contains the following statement: "Resin from knots and sap streaks will make paint brittle unless properly coated with shellac or aluminum paint."

Knot Sealer WP-578 was developed after much research because neither shellac nor aluminum paint are satisfactory sealers for knots. This failure of shellac and aluminum paint as knot sealers is likewise brought out in the "Paint Manual with Particular Reference to Federal Specifications", Report BMS-105, 1945, U. S. Department of Commerce.

ARTHUR B. ANDERSON
Research Chemist
Western Pine Association
Portland 4, Oregon

Productive Issue

To the Editor of Chemical Industries:

Your February issue has proven a delight to our scientists, a dismay to our librarians. It has been found so full of stimulating ideas of interest to us that our copies have been circulating the scientific staff ever since they arrived, while our librarians are frantically trying to corral them back into the library.

We find the Newsletter, What's New, and the CI Reports, such as on drying oils, particularly valuable. I alone have marked 18 items in the issue for the attention of our staff, and at least four of our new research projects will have come from the creative stimulation supplied by this February issue.

We particularly value the fullness of content in the What's New section where you appear to write an article only if you really have something to say. I suppose a good deal of the material in the What's New section is not really new to the specialists on our staff who are well up in their respective fields. However, the full presentation does serve to guide the judgment of those who are responsible for the selection of research project and for the direction of growth of our organization.

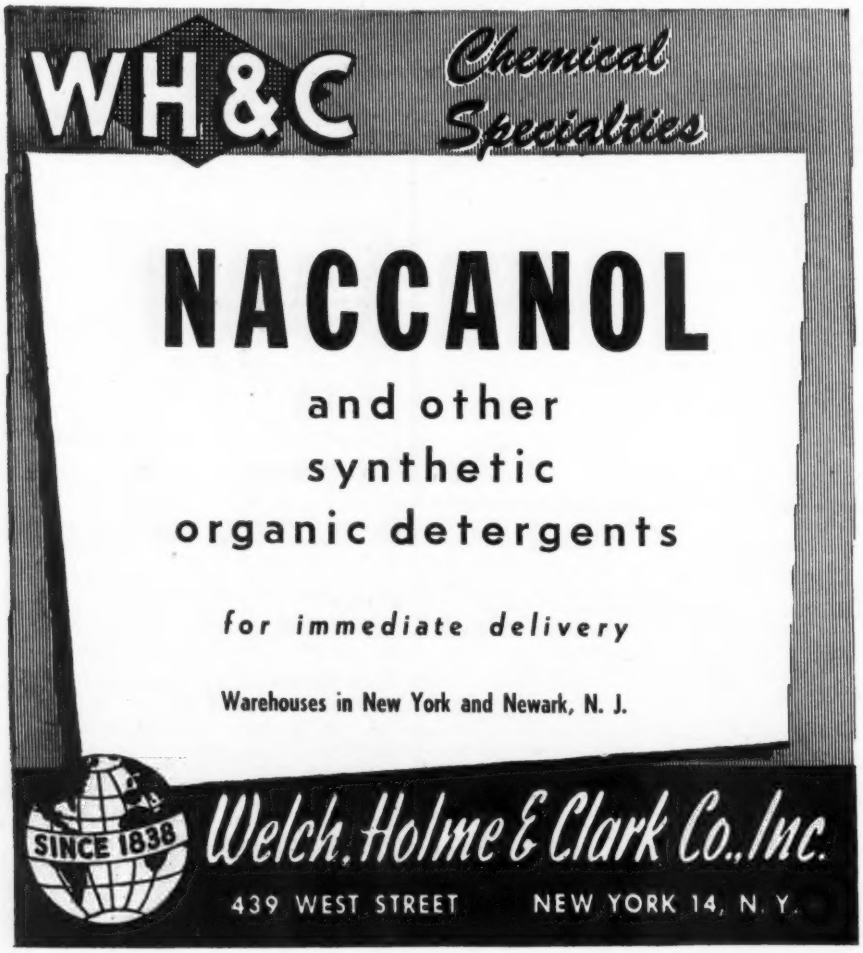
LOUIS KOENIG, Chairman
Chemistry and Chemical Engineering Section, Armour Research Foundation
Chicago 16, Illinois

Boom Boom

To the Editor of Chemical Industries:

The article "Boom in the Southwest" which appeared in your March, 1947, issue has been of great value to us here. We have used the data in this article extensively to answer many queries concerning the chemical industry of the entire Southwest, and we are very sorry to hear that you are out of reprints.

CONRAD H. COLLIER
Chamber of Commerce
Houston, Texas



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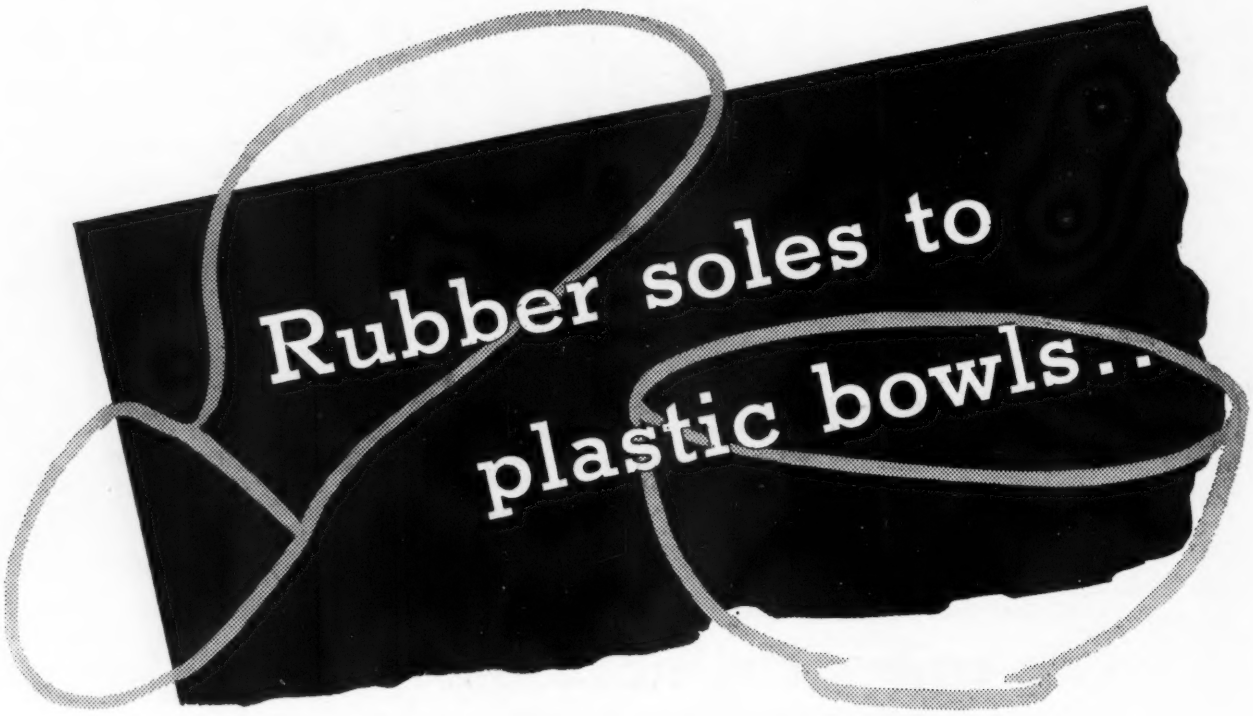

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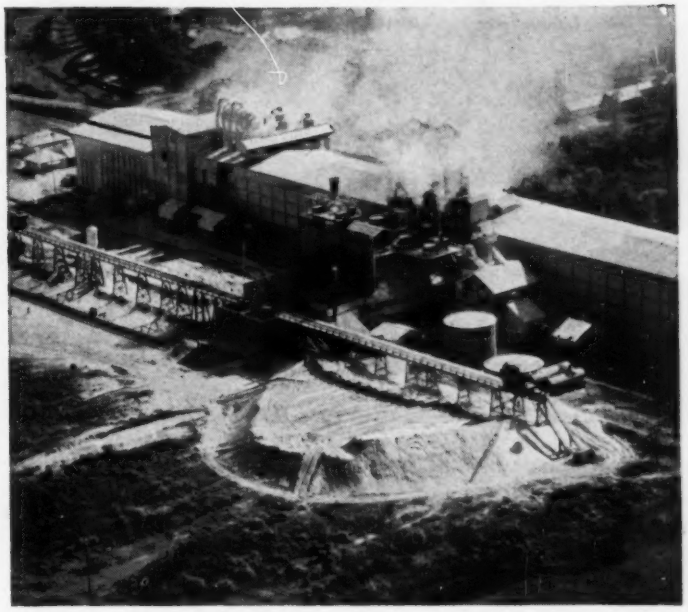

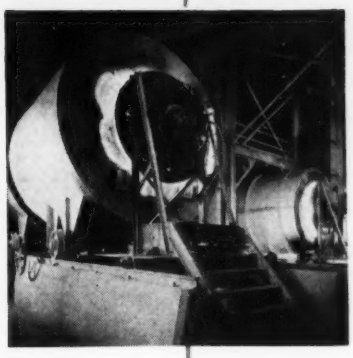

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New drying, storage and shipping facilities are now under construction at Noralyn Mine. When these facilities are in operation, Mulberry with its expanded capacity, will be able to handle an even larger tonnage of phosphate from Peace Valley and Achan Mines.

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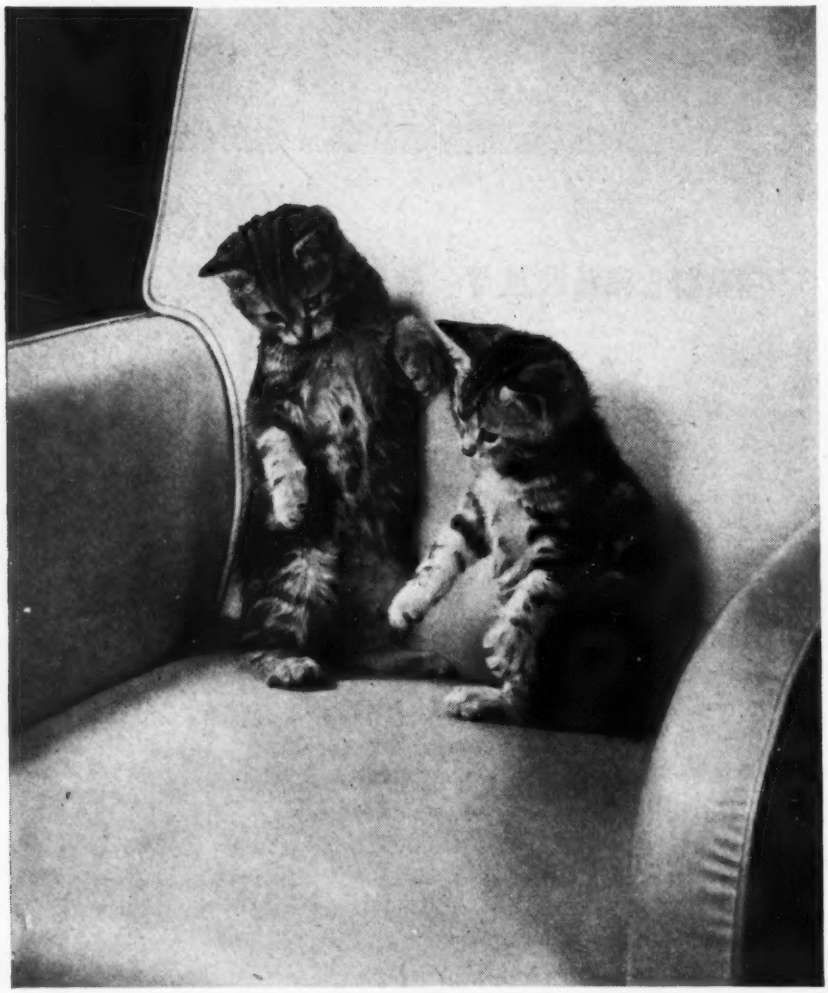
Life...on the



EVEN CATS HAVE TROUBLE SCRATCHING the new, tough, durable upholstery materials produced with the help of ACRYLONITRILE, the versatile chemical developed commercially by Cyanamid. Used for a considerable number of years primarily in the manufacture of oil-resistant synthetic rubber, the applications of ACRYLONITRILE have been so expanded that it has become the key material in a whole new group of plastic coatings and synthetic fibers.

While ACRYLONITRILE is responsible for the development of upholstery material that can resist scratching, tearing, scuffing and stains, it is also an important material in the production of such products as transparent shower curtains, rainwear, garden hose, floor coverings, handbags, shoes and packaging materials of improved quality and appearance.

ACRYLONITRILE is an effective insecticide, an important intermediate in chemical manufacture, and it imparts desirable features to adhesives and plastic products. Researchers in many fields are continuously finding new uses for this adaptable chemical. Its potentialities are still largely unexplored.

RAISING ONIONS TO ACCOMPANY YOUR STEAK is now a much simpler job for the truck farmer than it used to be, thanks to AERO* Cyanate Weedkiller, product of Cyanamid. This new chemical can be sprayed over onion fields to kill weeds without damage to the crop. Photo shows contrast between untreated and treated sections of an onion field.

Chemical Newsfront

PRODUCTION OF BEVERAGE BOTTLES IN 1947 was nearly double that of 1946—and it is safe to assume that the bottle-washing problem was correspondingly great. But where Cyanamid's AEROSOL** OS Wetting Agent is used in conjunction with the usual caustic soda wash, bottlers report that the job is speeded up considerably. Dried-out residue quickly releases its stubborn adhesion to the inside of these bottles, labels and dirt are washed away, and the bottles emerge cleaner, brighter and more sparkling than before.

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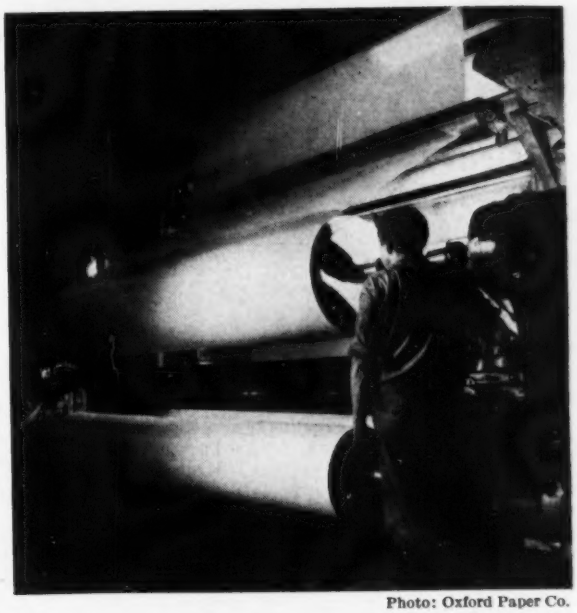

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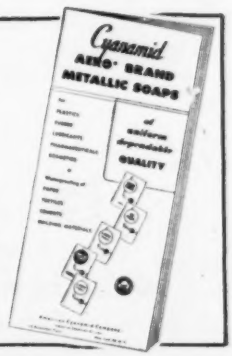
INCREASING THE "LIFE EXPECTANCY" OF PAPER has always been one of the aims of the paper manufacturer. Cyanamid's SODIUM PHOSPHO ALUMINATE is being used increasingly in the production of writing papers, book papers and other types. It imparts lower acidity and longer life to the paper and at the same time alleviates corrosion of wire and paper making equipment.

A NEW BOOKLET describing briefly the properties and primary uses of Cyanamid's complete line of AERO* BRAND Metallic Soaps is now available on request. Write to Industrial Chemicals Division, American Cyanamid Company, Department B.



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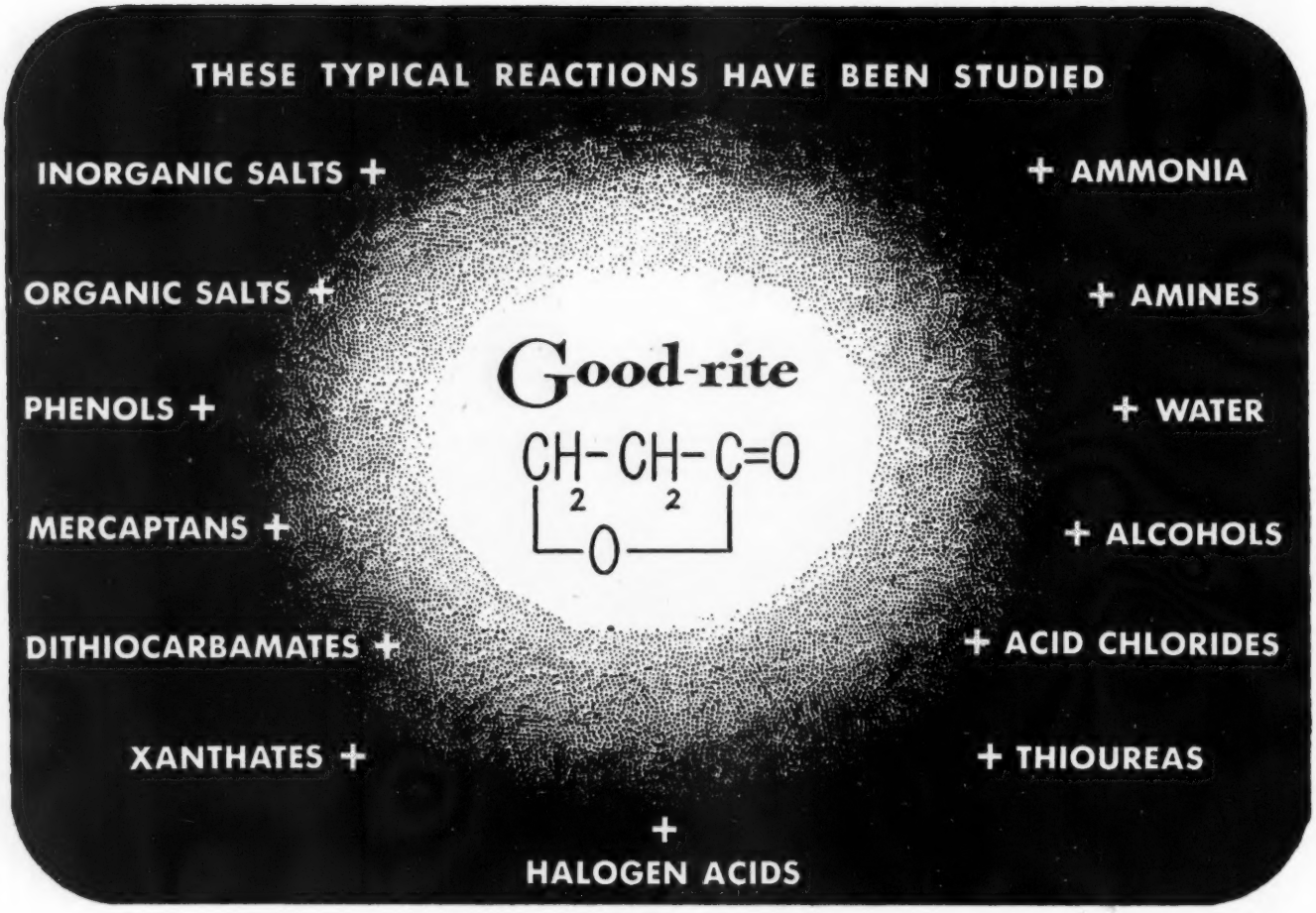
BEGINNING A NEW CHAPTER IN ORGANIC CHEMISTRY



HOW many other types of organic chemicals will react with Good-rite beta-propiolactone have not been determined! But its versatility as a basic chemical intermediate has now been firmly established. It has unusual chemical activity—it even reacts with sodium chloride. It makes commercially possible an ever-increasing number of organic chemicals never before practical. At the same time beta-propiolactone offers improved methods for commercial production of many industrial chemicals—in a variety of fields. A bulletin describing the properties of Good-rite beta-propiolactone may be obtained by writing to Dept. CE-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

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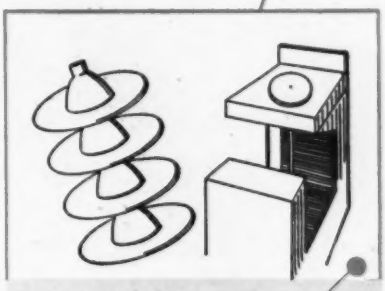

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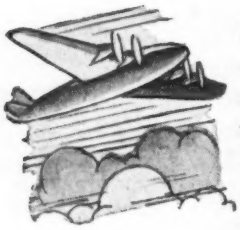

Every day it becomes more *a matter of course* to phone Hardesty for fatty acid requirements. Manufacturers of a diversified list of products have the Hardesty Habit . . . a habit which has formed because of Hardesty's habit of providing quality chemicals—*when* you want them, *how* you want them.

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Where it's a matter of assured shipments of quality fatty acids, it's a matter of course to contact Hardesty. Of course . . . it's the W. C. Hardesty Company, 41 East 42nd Street, New York 17. At the other end of your telephone wire: Murray Hill 2-1920.

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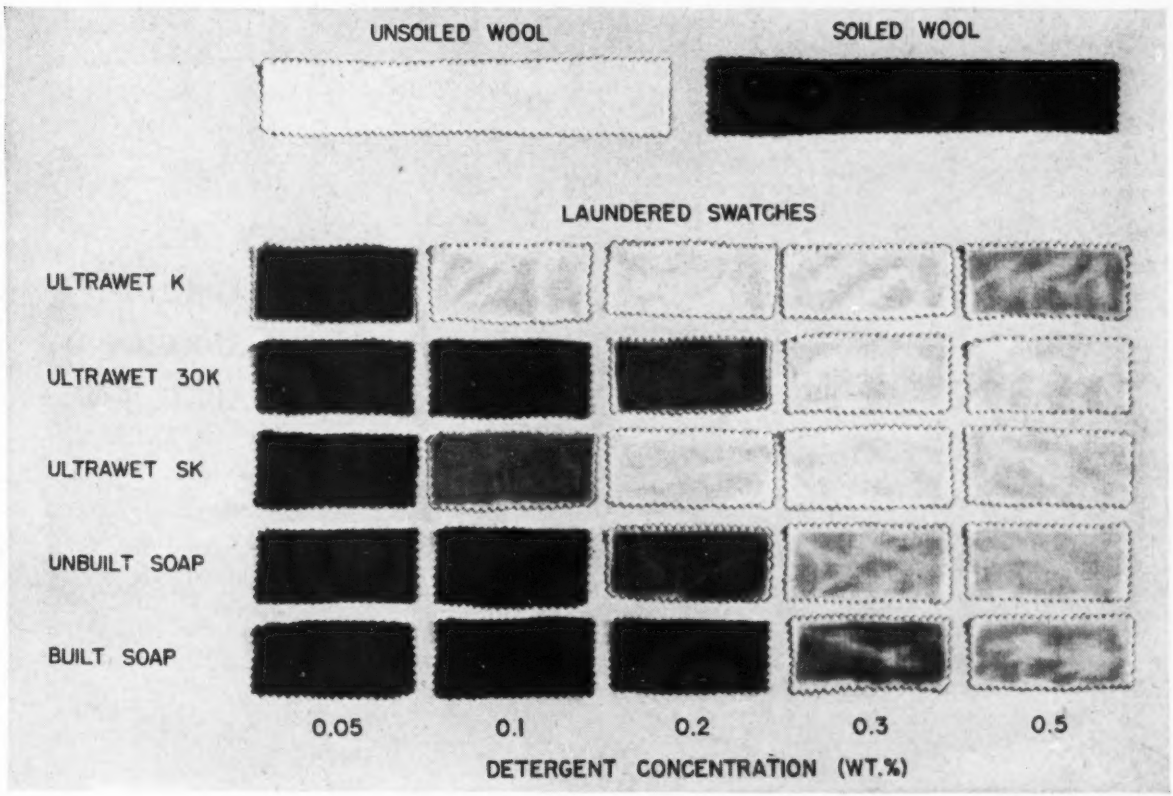
Wt. % Active Sulfonate—min.	85	25.5	35
pH—1% Solution	7-8	7-8	7-8



Picture shows superior wool detergency of Ultrawet K's over built and unbuilt soaps. Wool swatches impregnated with a synthetic soil are washed in a standard launderometer. The wash solution consists of stated concentrations of detergents and water with a hardness of 100 p.p.m. Tests are conducted for 20 minutes at 150° F. and followed by 2 rinses.

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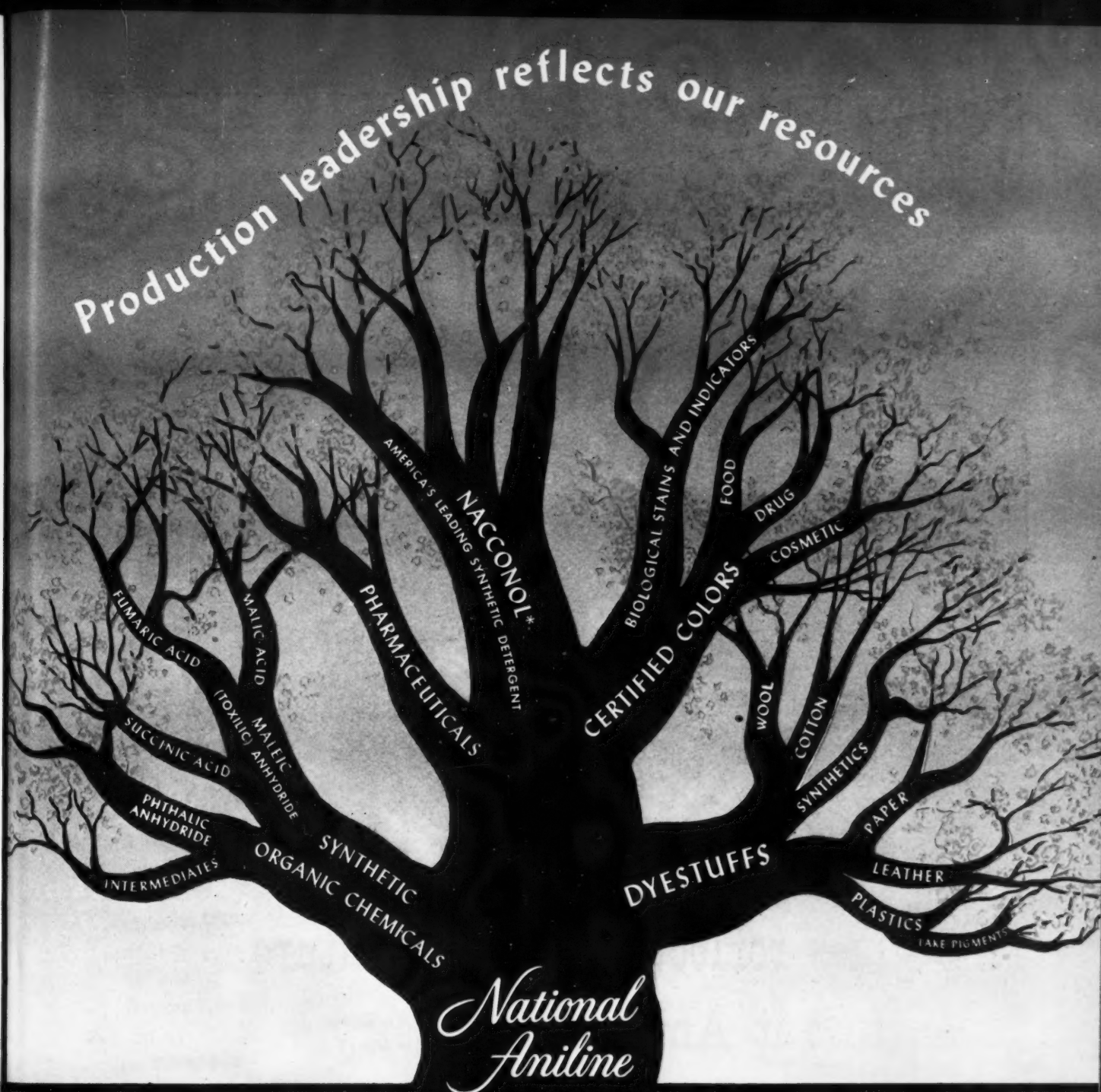

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The mirror shown here was made from the first piece of plate glass made commercially in this country. It was cast in 1870 in the factory of Captain J. B. Ford and now adorns the home of his granddaughter, Mrs. Nell Ford Torrey.

This glass reflected a bright future for an infant American industry

Back in the days before the bustle, when gaslights gleamed in the nation's homes, an enterprising gentleman began to tackle the problems of making *plate glass* commercially.

His experiments resulted, many years later, in three thriving glass factories in Western Pennsylvania. The region roundabout provided his plants with an abundant supply of coal, natural gas, white sand and grinding sand. But he lacked the all-important alkali, Soda Ash. And Soda Ash, in turn, required a source of limestone and salt.

In 1890, while traveling northward on the train, the glass-maker heard a fellow-passenger's "hard luck" story of a rolling mill that had drilled for natural gas in Wyandotte, Michigan, and struck *rock salt* instead.

For Captain J. B. Ford, founder of America's plate glass industry, the tale of the "useless" salt ended a long search for a vital raw material.

On "hard luck," courage and a hunch, Captain Ford—then a man of eighty—stepped off the train to establish the company that is now Wyandotte Chemicals Corporation.

Throughout its 58 years of growth, Wyandotte has maintained its interest in the glass industry and remains today one of the principal suppliers of Soda Ash.

During 1948, with a plant expansion of $25,000,000, the company will place in operation facilities which will materially increase its production of this basic chemical.

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- CORROSION INHIBITORS
- FLOTATION REAGENTS
- RUBBER VULCANIZATION ACCELERATORS

SPECIFICATIONS

Color	Water-white
Specific Gravity at 20°/20°C.	0.76
Acid Insolubles	Max. 0.16%
Dibutylamine Content	Min. 98%
Distillation:	
Initial boiling point	Min. 154°C.
Not less than 95%	Below 161°C.
Not less than 97%	Below 162.5°C.
Final boiling point	Max. 167°C.

OTHER PROPERTIES

Average Weight per gal.	6.33 lb.
Flash Point (open cup)	135°F.
Freezing point	<—50°C.
Surface Tension at 20°C.	24.7 dynes/cm.
Viscosity at 25°C.	0.89 centipoise

AVAILABILITY

Dibutylamine is available in drums and tank cars.

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THE ARMIDS

The Armids (aliphatic amides) are high-melting, wax-like nitrogen containing chemicals. They are used in printing inks as "all-weather" anti-scratch materials. Other uses include: emulsion stabilizers and thickeners, dye solubilizers for carbon paper, anti-blocks for plastics, chemical synthesis.

THE ARNEELS

The Arneels (aliphatic nitriles) are non-toxic organic cyanides. They are efficient softeners for certain synthetic rubbers or elastoprenes and synthetic rubber-like elastics or elastoplastics. Other uses include: rust preventatives, lubrication assistants for textiles, and water-proofing compounds.

THE ARQUADS

The Arquads (quaternary ammonium salts) are cationic in character and are water-soluble. They have excellent germicidal and surface active properties; are effective also as cationic textile softeners and ore flotation reagents. Other uses include: anti-static polishes for waxes, detergents, and alkaline cleaning compounds.

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Chemical Industries

THE MAGAZINE OF THE CHEMICAL PROCESS INDUSTRIES

Newsletter,
July, 1948.

For Your Information:

Production of polyperfluorovinyl chloride (trifluorochloroethylene) will soon be announced by M. W. Kellogg Co. To be sold as Kel-F, the new heat-resistant plastic is somewhat similar to Teflon in its properties. Incidentally, this marks Kellogg's first venture into chemical production.

The first commercial embodiment of the Oxo reaction--olefins plus carbon monoxide and hydrogen (CI, February, '47, p. 232)--will be Esso Standard Oil Co.'s new iso-octyl alcohol plant, due to start up some time this summer. Running a close second will be the production of nonyl alcohol at Whiting, Indiana, by Standard Oil Co. (Ind.) (CI Newsletters, Sept., '47, and May, '48). Conversion of existing high-pressure equipment will provide the facilities for the latter plant.

* * CI * *

A new monosodium glutamate process based on grain gluten has been developed by International Minerals & Chemical Corp. Appearing to offer advantages over present methods used in the industry, the process is now in pilot plant. International, by the way, is now test-marketing MSG in retail stores in Detroit and other Midwestern cities. It is being sold under the same trade name, Accent, used in selling to the trade.

A fluosolid catalytic oxidation of hydrogen chloride to chlorine has been patented by Standard Oil Development Co. According to the patent (U. S. No. 2,436,870), the process consists of suspending iron oxide in hydrogen chloride gas and passing the mixture into a heated reaction chamber at 250-400° C. The solid particles--now ferric chloride--move downward and meet an oxygen-containing gas in a chamber at higher temperature. The oxygen releases the chlorine and the iron reverts to the oxide.

* * CI * *

Calco Chemical Division of American Cyanamid Co. is rushing expansion of its beta-naphthol capacity, hopes to complete it by year's end; and the Hilton-Davis Chemical Co. Division of Sterling Drug expects to complete its $1,200,000 beta-naphthol plant at Cincinnati by fall. If market conditions so dictate, the plant can be switched to phenol manufacture. Although dyestuffs are easing (CI, June, 1948,

p. 905), beta-naphthol has been, and still is, one of the more obstinate bottlenecks; but Calco's and Sterling's hopes will ease the situation by 1949.

Dow Chemical Co. will soon commercialize a Styron-brand polystyrene capable of withstanding sterilization temperature (214 to 216 degrees F.) for several minutes, thus extending its field of application. Secret of the high-temperature resistance: a more thorough elimination of styrene monomer and other impurities from the polymer.

* * CI * *

Ozark-Mahoning Co., Tulsa, has been making fluophosphoric acids, is now adding various salts to its production schedule. Among them are the sodium, potassium, and calcium monofluorophosphates and the potassium, ammonium, and pyridinium hexafluorophosphates. Stable and non-corrosive, they are a convenient source of fluoride ion.

Technicolor odor photography is coming into use for identifying organic substances in complex mixtures. One of the important uses, claims Waldemar Dietz, consulting chemist heading up a project on the technique, is the identification of sterols in urine by which a more rapid diagnosis can be made of cancer in the human body.

* * CI * *

Immediate construction of two superphosphate fertilizer plants is planned by Empire Chemical Corp., Spokane, Washington. The plants--one at Spokane and the other at Yakima, Ellensburg, or Pasco--will represent a half million-dollar investment and will utilize phosphate rock from the Maidenrock, Montana, mine.

Now being marketed in five states where apple scab is a serious crop menace is a new agricultural fungicide, "Stanofide", developed by Standard Oil Co. (Ind.). Practical in oil-base sprays and compatible with many standard insecticides, the new material is claimed to be as effective as, and more convenient to use than sulfur.

* * CI * *

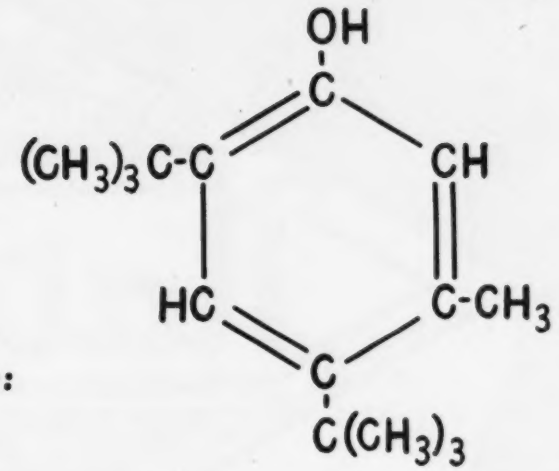
Here and There:

Aluminum Co. of Canada is investigating sites in British Columbia for a proposed hydro-electric power and aluminum plant. The latter, according to present plans, would produce an annual 250,000 tons of pig aluminum. Excess power capacity would provide for further industrial development of the region...Jefferson Chemical Co. is distributing samples of an alkyl aromatic for testing as a detergent raw material...An oil-from-shale process is covered by a patent (No. 2,435,746) recently issued to Union Oil Co...Gallowhur Chemical Co. is leasing a plant in Ossining, N.Y., will move its manufacturing operations from Massachusetts about September 1...The first license to apply Shell's vapor-phase inhibitor (VPI) has been granted to a paper converter. Two additional licenses will, in the very near future, probably be granted.

The Editors

DBMC 4,6-DI-tert-BUTYL-meta-CRESOL

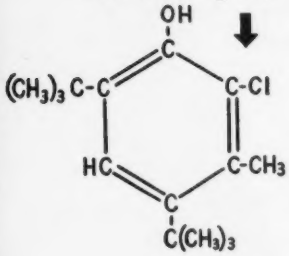
Are these reactions of DBMC useful in your processes?



This interesting alkylated phenol undergoes the reactions shown below:

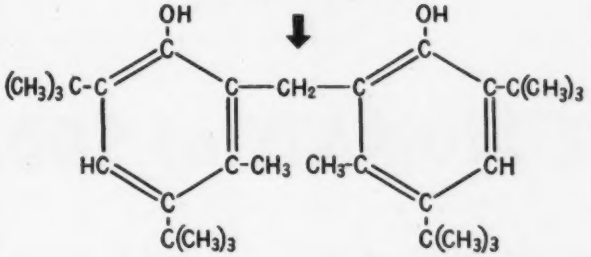
Chlorination

$DBMC + SO_2Cl_2$



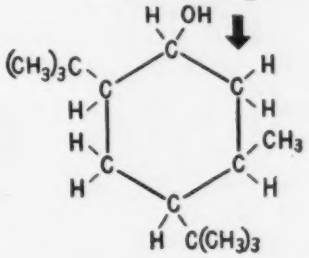
Aldehyde Condensation

$2\ DBMC + HCHO$



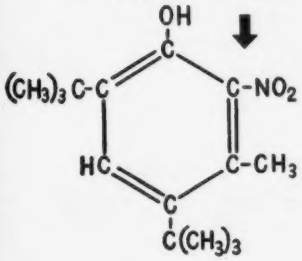
Hydrogenation

$DBMC + 3H_2$



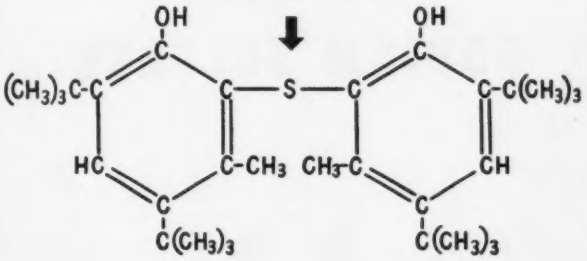
Nitration

$DBMC + HNO_3$



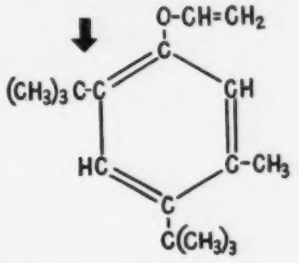
Sulfurization

$2\ DBMC + SCl_2$



Vinylation

$DBMC + HC{\equiv}CH$



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SECRETS AND COMPETITION

by ***ROBERT L. TAYLOR, Editor***

SECRECY IS ONE OF THE legitimate tools of competitive enterprise. Few will disagree that a company should keep to itself certain key information on its products and processes if it is to its advantage to do so.

We at Chemical Industries thrive on, and base our whole publishing service on, information that industry is cooperative enough to give us. We know the kind of information that companies do not like to disclose. We also are fully aware of the variety of policies in different industries and companies on the matter of releasing information.

The point we wish to raise here is mainly one of degree. Can chemical companies as a group, and thereby individually, benefit by freer disclosure of product and process information than is now the custom in much of the industry?

We believe they can.

In saying this we do not overlook the tremendous strides that have already been made in the general attitude toward disclosure of industrial information. It has been but a couple of centuries since most of the world's industry depended on trade secrets handed down from father to son. Patents are a relatively new invention. But it was with the introduction of the patent system, and the freer exchange of technical knowledge thus inspired and encouraged, that industry broke its restraining bonds and became the abundant producer it is today.

It is unfortunate that the influence of the old trade secret philosophy still lingers on in some of the fields of chemical processing.

In some instances this appears to be for no other reason than that nobody has taken the initiative in getting rid of it. How many times in our own experience have we met with the reply, in response to a request for an article. "Sorry, but we can't publish anything on this. Our competitors never do, so why should we?" These same people readily admit they know quite a bit about their competitor's process, but because of some magic one-way communication system, he isn't supposed to know anything about theirs. Many tight-mouthed companies foolishly believe they are guarding secrets when it is quite apparent their competitors are picking up such information relatively easily.

But suppose the competition actually hasn't found out? The chances are still that he is doing his best to develop something better, and the company that lulls itself into a feeling of security based on secrecy is building on a precarious foundation indeed. Industrial secrets seem to have a habit of deteriorating when stockpiled.

It was that master of research, "Boss" Kettering of General Motors, who said, "When you lock the door of the laboratory you lock out more than you lock in." The same could be said of a factory or plant. Industry can only grow and develop by a wide distribution of information about its results. In no other way can it bring so many new winds to bear on its problems. The petroleum industry is an outstanding example. The veil of secrecy has been notably absent among petroleum producers and refiners, with the result that from an engineering standpoint oil refining is today probably the most highly developed of any of the process industries.

Restriction of information, as pointed out by Dr. E. U. Condon of the National Bureau of Standards, is designed to conserve a static position based on present knowledge. But by giving up some of our present knowledge we grow in total knowledge, and everyone shares in the benefits.

More chemical companies should face the problem of secrecy in a common-sense manner. In disclosure of information on processes and plants it is neither necessary nor desirable to reveal every last detail of information. The objective should be to find a happy mean where sufficient information is released to make a substantial contribution to the common good and to stimulate thought and ideas, while yet not revealing details that would permit simple and effortless copying.

Certainly there are so many aspects to competition in the chemical field that the more general release of certain basic information can still leave a large area in which an individual company can exercise ingenuity, enterprise and rivalry.

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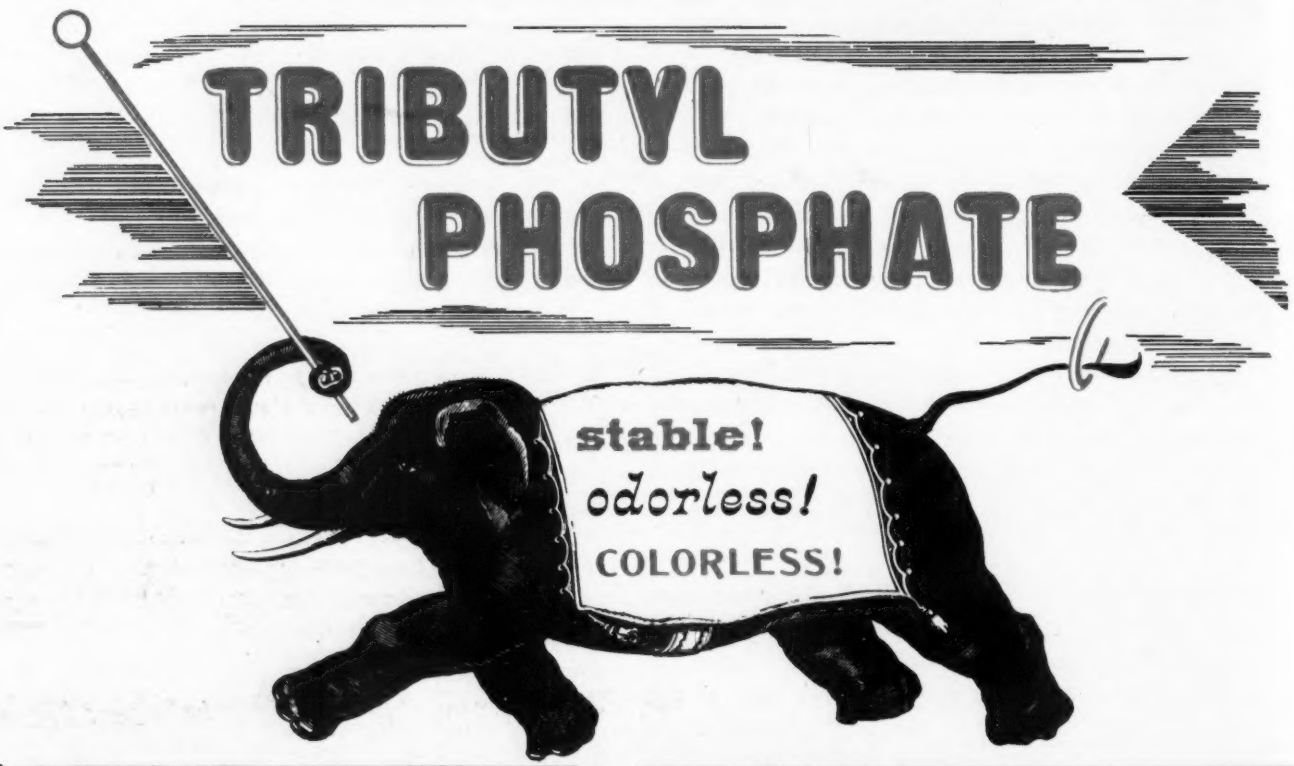

SPECIFICATIONS:

SPECIFIC GRAVITY: 0.973 to 0.983 at 20°C./20°C.
ACIDITY: Not more than 0.05%, calculated as phosphoric acid.
WATER: No turbidity when one volume is mixed with 19 volumes of 60° Bé. gasoline at 20°C.
COLOR: Water-white.

PROPERTIES:

MOLECULAR WEIGHT: 266.32.
ODOR: None.
REFRACTIVE INDEX: 1.4226 at 20°C.
BOILING POINT: 177°C. at 27 mm. of mercury.
LATENT HEAT OF VAPORIZATION: 55.1 calories per gram at 289°C.
DIELECTRIC CONSTANT: 7.973 at 30°C.
MELTING POINT: Below −80°C.
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What's new

MILLIONS FROM MOLDS

Production of the mold-grown antibiotics, penicillin and streptomycin, has become big business in the chemical industry. Their importance is still growing, and new antibiotics are on the way up.

PLANTS are being built all over the world to produce antibiotics—substances which until ten years ago were buried deep in the pages of academic journals. The magic wand of engineering ingenuity has transformed them into salvation for millions of afflicted people and —incidentally—pay dirt for the chemical industry.

Most people think that it all started with Fleming's discovery, back in 1928, of penicillin. Actually, the idea of fighting a deadly organism with a harmless one (or its secretions) was successfully realized over 60 years ago, and in the intervening years several microbiological substances were found to arrest the growth of disease-producing "bugs." Fleming's discovery, like many others, was made, recorded, and forgotten. Then, when tyrothricin was discovered in 1939, a group of English workers started to work in earnest on antibiotics; and they resurrected Fleming's original observations and carried on from there.

Five Years, 200,000 Per Cent

The dramatic story of penicillin has been told countless times. The punch line for the chemical industry, however, is the enormous rate of growth in penicillin output. In 1943, U. S. production was 21 billion units; in 1945, 7,454 billion; and last year, 41,426 billion—an increase over 1943 of 200,000 per cent. The 1947 figure, incidentally, translates into over 50,000 pounds—worth about $150,000,000.

Meanwhile several plants—many of them American-designed—have been built throughout Europe.

A new drying technique has made news recently (CI Newsletter, February, 1948). The costly freeze-dry method has been replaced in one plant by spray-drying to cut processing costs. Also, the drugs procaine and staticin caronamide prolong the effect of penicillin, allow less frequent—and thus more convenient— injection.

Current producers of penicillin include Merck & Co., Cutler Laboratories, Chas. Pfizer & Co., E. R. Squibb & Sons, Eli Lilly & Co., Parke, Davis & Co., Upjohn Co., Abbott Laboratories, Commercial Solvents Corporation, Heyden Chemical Corporation, Bristol Laboratories, Lederle Laboratories, Wyeth, and Schenley Laboratories.

Streptomycin Catching Up

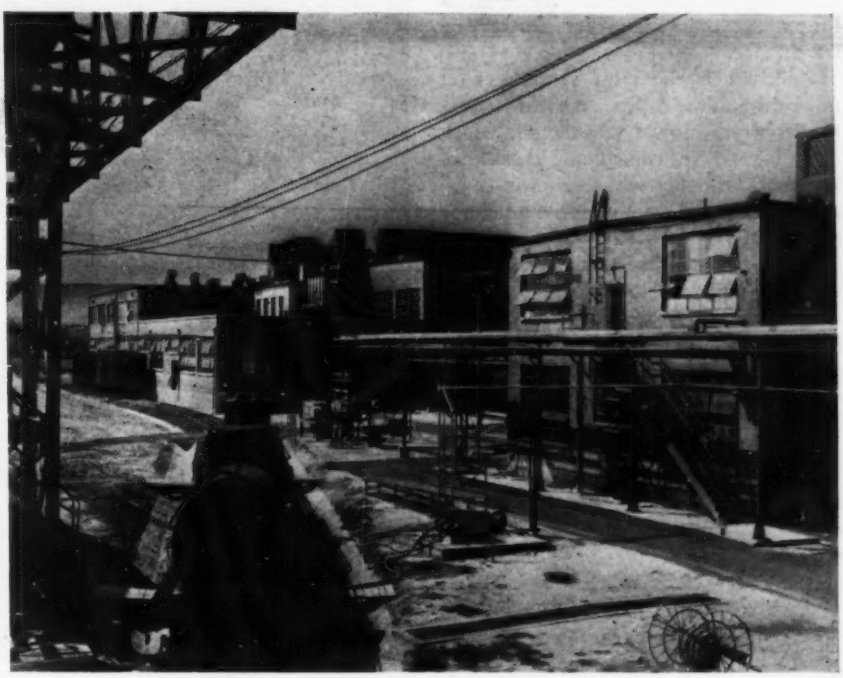
Pound for pound, streptomycin is giving penicillin a close race. It is currently being produced by eight U. S. concerns at the rate of 2 million grams (4,400 lbs.) a month, of which Merck probably makes at least half.

Merck got into the streptomycin game early. The company supported research at Rutgers University, made an exclusive licensing arrangement with Rutgers' research foundation for any patentable results. When Waksman and his co-workers stumbled onto streptomycin, they —and Merck—quickly realized that it was too big for them alone, and the process was licensed to other producers. But Merck pushed plant construction, got in on the ground floor* before other licensees were ready to make the new antibiotic.

Pfizer and Squibb were the first after Merck to complete manufacturing facilities; Upjohn and Abbott followed in close order; and more recently, Parke, Davis and Lilly started producing the drug. Commercial Solvents was an early entry in the field and then dropped out, but has again climbed aboard. Two other companies—Heyden and Bristol Labs—are now entering the field with substantial production.

Streptomycin production—like that of penicillin—is also faring forth across the Atlantic. Boots Pure Drug Co., Glaxo Laboratories, and the Distillers Co. are readying plants in Britain, and facilities

* Not so with penicillin. Merck underestimated the complexity of the penicillin molecule, thought it could be synthesized commercially. Consequently, fermentation people like Pfizer and Commercial Solvents exploited their specialty and carved out larger wedges of the penicillin pie.



MERCK'S STREPTOMYCIN PLANT: Production . . .

are being built in France. All of these will be producing shortly.

Newer Ones Coming Along

Just as penicillin was not the first antibiotic discovered, neither was it—nor streptomycin—the last. Indeed, tyrothricin, the spark that set off the whole shooting match, is being made commercially by Wallerstein Laboratories and Sharp & Dohme.

Commercial Solvents and Pfizer are actively working on bacitracin, an antibiotic discovered only three years ago and which, Waksman believes, may eventually supplant as much as 10 per cent of penicillin. An even newer material, polymyxin, is now being investigated in the laboratories of American Cyanamid Co. and Burroughs Wellcome & Co. (The British call the same—or, at least, a very similar material—aerosporin.) This substance may take over some of streptomycin's functions.

Parke, Davis is now making chloromycetin, a chlorine-containing compound that exhibits antibiosis against large viruses (CI, Dec., 1947, p. 980). It is reported that Lederle Laboratories will also make the same substance, but under a different name. In that it attacks some virus diseases, it offers hope of breaching a hitherto impregnable stronghold of disease.

Goal Still Far Off

Well over a thousand papers have appeared on streptomycin alone—and the last word has by no means been written. Most of them, of course, deal with clinical uses. Antibiotics have scratched off many diseases as conquered or conquerable, but the unscratched list provides life-and-death incentive for further research.

Penicillin is the most versatile, most universal antibiotic. Streptomycin is proving its worth against tuberculosis, which doesn't yield to penicillin. These two antibiotics, together with bacitracin, polymyxin, and tyrothricin, comprise a staunch armor against practically the whole bacterial spectrum. Now chloromycetin has appeared as the first heavy boulder in the wall of defense against viruses.

But there are chinks in the armor. An occasional "bug" gets through, begets a multitude of antibiotic-resistant progeny. Waksman tells of a pneumonia patient who was treated with penicillin and recovered; two weeks later he suffered a relapse, penicillin was of no avail, and streptomycin had to be invoked to save the man's life.

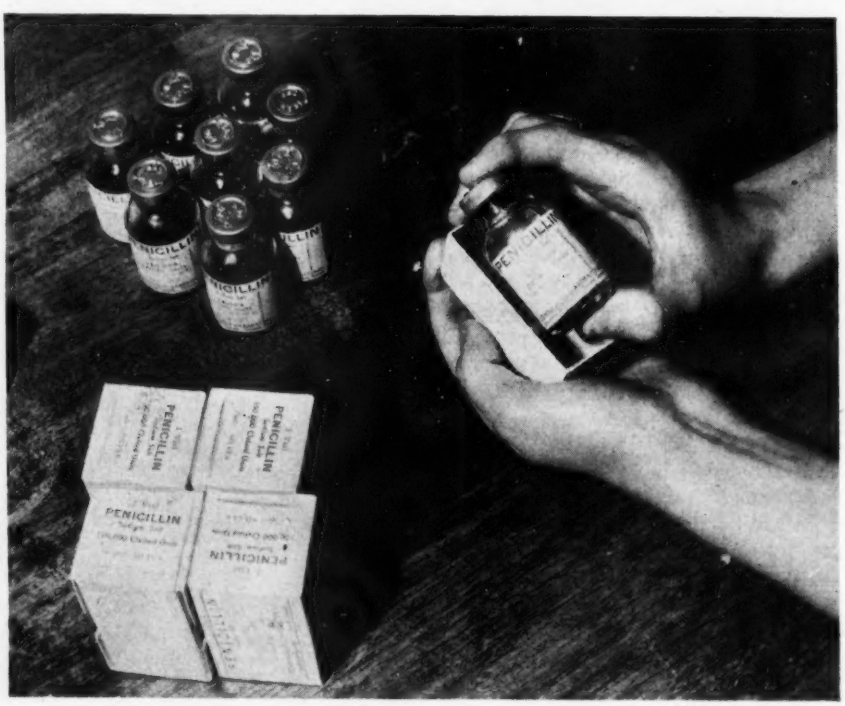
One way of mending the cracked armor is to develop new, stronger strains of the antibiotic-producing mold by exposing the mold to x-rays, ultraviolet light, or chemicals (CI, Sept., 1947, p. 380). The rough treatment kills off the weak sisters, induces variations in the mold and its secretions.

Waksman points out that it's the one obstinate maverick in a thousand bacteria that refuses to yield to an antibiotic. If some substance could be found to kill just that one, only a jot of it, together with the antibiotic, would be required to give a 100 per cent kill. That's the approach, he thinks, that holds the most promise.

Then there is the ever-present possibility of finding new antibiotics, both natural and synthetic. An example of the latter type is acrylophenone. That particular one is too toxic, but its effectiveness justifies all-out investigation of other simple, easy-to-make compounds. Natural molds and their derivative variants are, practically speaking, numberless as the sands at Coney Island. But out of 10,000 mold cultures, probably only 1,000 will show any antibiotic activity, and maybe only one will produce an appreciable quantity of substance which meets the requirements of isolability, non-toxicity, and *in vivo* activity.

It's difficult enough to find new antibiotics, let alone find one that's universal against all pathogenic invaders. Untouched by any of the antibiotics discovered so far are the common virus infections—common colds, "flu," poliomyelitis, etc.—and the berserk cells that cause cancer. Even these, Waksman believes, will eventually succumb to some antibiotic substance.

New antibiotics certainly don't wear signs reading "Here I am." But scientists are used to looking for the 606th syphilis cure, the 1000th electric light filament, the 5,000th antimalarial. New discoveries will undoubtedly come along, and engineering skill is pacing up and down in front of the laboratory doors, ready to extend those discoveries into production, profits, and prescriptions.



National Film Board

PENICILLIN VIALS: . . . Profits and prescriptions.

STRAINING LIQUIDS

Close fractionation with minimum labor is claimed for a wire-saddle column packing.

WHEN you want to separate fine particles from coarse ones, you put the solid through a wire mesh. It isn't quite that simple to separate low-boiling liquids from high-boiling ones, but the same material – wire mesh – stamped into wire-saddle column packings—is doing just that with excellent results.

Fo many years the Stedman packing has been the last word in pilot-plant column packings, although it is difficult to install, expensive (because it must be machined to fit), and inflexible.

An Airy Start

Efficient, economical fractionation was a consummation devoutly to be wished by Arthur D. Little, Inc., for that organization was deep in tonnage-oxygen production problems. Howard O. McMahon, of the Little staff, came up with a column packing—easily installed, low in cost, and flexible in operation—that is carving a niche for itself in development engineering.

For its shape McMahon borrowed the

HOWARD O. McMAHON: He learned the value of a hole.

general outline of the Berl saddle, which can best be described as a saddle from the front and an upside-down saddle from the side; but instead of using ceramics, he stamps his from wire mesh. The size of the mesh is unimportant as long as the liquid being fractionated can get through, enabling the under side of the saddle to do its part of the separating. This more complete use of the surface area is believed to account for the greater efficiency of the McMahon packing.

Contributing to its lower cost is the fact that it is a dumped packing, not requiring machining as does the Stedman equipment. And once it is in place, it stays there; for the ragged edges of the saddles holds the packing together in a coherent mass that doesn't shift or settle.

Finding New Jobs

Liquid air isn't the only beneficiary, for the packing is applicable to any liquid fractionation. (Obvious exceptions are liquids that polymerize upon distillation or carry suspended solids; they would plug up the interstices.) The wire saddles—now marketed by Wire Cloth Products, Inc.—are being used in pilot-plant separation of Fischer-Tropsch oxygenated products and in moderate-volume production of a new plastic monomer.

Whether this packing will be used on large-scale distillation units, engineers hesitate to predict. Designers have had years of experience with bubble-plate columns, have accumulated a formidable mass of data to insure designs that meet the specs.

But pilot plants, where precedents are broken even before they're established, are a different story; and it's a likely bet that more of them will be "saddling up."

BUG BLUES

Insecticide men air woes in effort to pull their business out of the doldrums.

A GHOST flitted about the spacious halls of the Monmouth Hotel at Spring Lake, N. J., where the National Association of Insecticide and Disinfectant Manufacturers, Inc. held its thirty-fourth mid-year meeting last month. It was not native to the premises; the insecticide men had brought it along. Finally, on the last day of the gathering, Gordon M. Baird, president of NAIDM, officially recognized its existence in a scheduled open forum discussion of the question "What has happened to the insecticide business?"

Sales Policy Sour

Many of the members, speaking out of long experience in the field, and not as company representatives, felt that the fundamental sales policy of the industry has missed the boat by confusing the customer with too many products.

Some of the trouble was laid to the virtual removal of pyrethrum from private use during the war, and the inefficacy of some of the wartime substitutes. When DDT came along, many firms not understanding the insecticide business entered the field with poor formulations and extravagant claims for some of the products. Moreover, the public, expecting quick knockdown and not willing to wait for the bugs to fall, didn't feel it was getting its money's worth. Storekeepers, still mindful of the difficulties of securing stocks during the war, overordered, and the insecticide people oversold. (The best guess of the size of the market is 50 million gallons of all insecticides.) Estimates of the amount of "cat and dog" stocks still on shelves varied from 2 per cent to "a lot."

Another criticism leveled at the industry was that the materials have such offensive odors that the housewife prefers insects to insecticides. It was charged that the desire to make products too cheaply was the cause of this.

Profit No Longer There

In a discussion of the last two years as the "worst in twenty-five years," it was pointed out that the huge margin of profit that once existed is no longer there. Petroleum people are getting out because a smaller percentage of their products is being used, and today's higher freight rates makes national distribution unattractive.

On the matter of spraying of private property by public agencies, there was divided opinion. Reports by men in the Midwest and South, where this has been generally done, indicated that sales of insecticides for the household picked up when people saw how effective these measures were. Others said that sales fell off, as it was assumed that the government was killing the bugs. Some of these adverse effects were attributed to salesmen's "writing off" such areas.

Ain't No Flies

The remark that there have been poor fly years was in line with the feeling expressed at other times that the long cold springs of the past two years have killed the bugs aborning. The housing shortage, with fewer moorings and fewer reinfestations of premises, also caught a share of the blame.

It was generally believed that the quality of insecticides has gone up, but that the manufacturers have fallen down

G. M. BAIRD: No bugs in the night.

in advertising (only 3 per cent of sales is said to be used for this), in educating the clerks who sell the products, and in educating the consumers who use them. Honest soul-searching, it was felt, would enable them to find the market that once was, and sell it.

NYLON IN REVERSE

A NOVEL application of a depolymerization is described in U. S. Patent No. 2,436,269, assigned to Du Pont. A mixture of ethylene, water, and carbon monoxide is heated to 100° C. for 12 hours at 850-1000 atmospheres pressure. The polymer which is obtained is oxidized by nitric acid in the presence of ammonium vanadate. The product is succinic acid. Increasing the ethylene ratio gives higher dicarboxylic acids.

SPENCER GOES CIVILIAN

Spencer Chemical Co. is latest prewar non-producer of ammonia to buy a surplus plant.

LIKE MANY a G.-I. who found a career in the army, the Spencer Chemical Co., Kansas City, Mo., after a long hitch in the interest of national defense, and a provisional continuation in its war-time capacity, has finally "gone civilian." The recent purchase of the surplus synthetic ammonia plant, Jayhawk Ordnance Works, Pittsburg, Kansas, from the War Assets Administration for $11 million culminates an association with the chemical industry that began in 1939, and figures to be of increasing benefit to both parties.

Pre-Pearl Harbor

Shortly before the war, Kenneth A. Spencer, then vice-president and general manager of the Pittsburg & Midway Coal Mining Co., presented the War Department with information on the best utilization of his tri-state district in the interests of national defense. In addition to plants for smokeless powder and shell-loading, the program included an anhydrous ammonia and ammonium nitrate solution plant which the government requested Spencer and Pittsburg & Midway to design and operate. A wholly-owned subsidiary of P & M, the Military Chemical works, Inc., was formed to carry out the assignment. Fittingly enough, the cornerstone of the Jayhawk Ordnance Works was laid the day before Pearl Harbor.

After V-J Day, the Spencer Chemical Co. was set up with Kenneth A. Spencer as president to operate the plant on a peace-time basis. A year of negotiations with the WAA resulted, by June, 1946, in a 21-year lease with an option to buy at a predetermined price within 13 years. Spencer didn't need 13 years to make up its mind to join the regulars. The necessary money for this and other company ventures comes from private placement of common and preferred stock. J. H. Whitney & Co., a New York brokerage house, is the largest minority holder of the common, and has two representatives on the board of directors. Spencer proudly notes that over 50 per cent of the common stock is held by its officers and employees.

Sound Basis

The installation at Jayhawk is sufficient to give anyone a sound position in the industry. Present facilities include the following: (a) an anhydrous ammonia plant; (b) a nitric acid plant; (c) an ammonium nitrate solution plant; (d) an ammoniating solution plant; (e) an aqua ammonia plant; (f) a dry ice plant; (g) a methyl alcohol plant. In addition, Spencer operates a plant at Parsons, Kansas, for graining 83 per cent ammonium nitrate solution into fertilizer.

Since the date of leasing, additional nitric acid facilities have been installed at Jayhawk, and additional ammonia capacity is currently being added. Although in March of this year a portion of the original ammonia capacity was converted to methyl alcohol, any loss of ammonia production is expected to be offset by this new construction. Present ammonia capacity is estimated to be in excess of 10,000 tons per month, to which the new facilities may add at least another 750 tons per month. A good guess would be that the nitric acid units are turning out 13,000 tons of 100 per cent acid per month. Methanol production is placed in the neighborhood of 2,000 tons per month.

For Uncle Sam

While proceeding on its own, Spencer took time in the summer of 1946 to form a wholly-owned subsidiary, the Emergency Export Corp., to operate on a cost-plus-fixed fee basis the following plants for the Army: the Cactus Ordnance Works, an anhydrous ammonia plant at Etter, Tex., and three ammonia nitrate graining plants (Cornhusker Ordnance Plant at Grand Island, Neb.; Nebraska Ordnance Plant at Meade, Neb.; and the Iowa Ordance Plant at Burlington, Ia.).

K. A. SPENCER: He surveyed an area.

For Spencer

Although these operations for the government are important, it is more interesting to speculate on the possible future plans of this relatively new face in the ammonia picture (CI, April, 1948, p. 567). Some inkling can be obtained from the construction of a $1-million formaldehyde plant near Calumet City in the Chicago area that is expected to be in production in early 1949. Some of the Jayhawk methanol will be shipped there for oxidation into an estimated 1,500 tons of 37 per cent formaldehyde per month. Production of urea would seem a logical move to provide a sound position in the plastics field. Expansion along the lines of pentaerythritol, hexamethylene-tetramine, paraformaldehyde, and methylated compounds is also possible.

JAYHAWK ORDNANCE WORKS: Now a private affair.

CELLS FOR LICENSE

DOMESTIC as well as foreign producers of chlorine and caustic will now be permitted to license Mathieson Chemical Corp.'s mercury cell developed last year (CI, August, 1947, p. 212), according to President T. S. Nichols. He added that a technical staff, now being organized and trained, will be available after September 1 to advise on construction, installation, and initial operation. Nichols foresees local expansion of chlorine-caustic production as a result of mounting freight costs.

PAN-AM PETROCHEMS

Pan-Am's new Chemicals Division is based on aromatics and the ability of double-bonded hydrocarbons to "double-up."

ANOTHER entry in the growing petroleum chemicals field is the Pan-American Chemicals Division of Pan-American Refining Corp. Formation of the new division last year, however, was little more than formal recognition of a going operation. Pan-American, which is an affiliate of the Standard Oil Co. of Indiana, has been making a line of petroleum-derived drying oils, solvents and resins for several years.

Employing about 150 people, the new division is headed by Frank J. Smith, who has been identified closely with the company's chemical operations since their inception.

It Took A War

Pan-Am really got its start in the chemical business during the war. In 1943, the Stone Oil Co., next-door neighbor of Pan-Am's big Texas City, Texas, refinery, discovered that its crude was particularly desirable for production of aviation gasoline. But having no facilities to produce such fuel, Stone was requested by the Government to send its crude elsewhere for processing, leaving its Texas City refinery idle. It therefore offered a lease on the facilities to Pan-Am, which Pan-Am accepted and eventually—because of the relatively small size of the equipment and tankage—adapted to some chemical side-lines. By 1947 chemicals had grown to such a substantial and important part of its business that Pan-Am purchased the Stone refinery outright.

Products

A major portion of the Pan-American Chemicals Division's current output falls under the heading of solvents. A large quantity of petroleum toluene is being produced, some of which is going into aviation fuel, however, as well as solvent uses. Also, four other high aromatic solvents with boiling points ranging between 200° F. and 450° F. are being marketed in tank car quantities.

Though not as large as solvents, the hydrocarbon drying oils, of which Pan-Am produces several types, are accounting for an increasing poundage of the Division's business. These oils, ranging in color from black to light amber and in viscosity from water thin to "stiff pastes", are used to decrease linseed oil requirements in paint and varnish, although the brittle film which they produce when used alone does not permit a full substitution. Another major use is in lithographic printing inks. The oils are believed to be cyclic unsaturates with two non-conjugated double bonds per molecule (iodine number, 200; mol. wt., 350).

Pan-Am's resins are produced by polymerization of high-molecular-weight olefins and retain a fairly high degree of unsaturation (iodine number, 200). The latest of this series (ring-and-ball softening points from 125° F. to 225° F.) will be introduced in the early fall. It will be much lighter in color than the others. The resins are competitive with other low-cost hydrocarbon resins and find their major use in varnish cooking, although large quantities go into printing inks.

Next?

Pan-Am officials are not reticent about the fact that they have further plans in the hydrocarbon specialties field. What these are, however, they are not yet ready to say. But one thing they are sure of is that they will stick to hydrocarbons for awhile.

OF MOTHS AND MEN

A small new company is making headway in selling the mothproofing market.

MOST FRIENDSHIPS formed in the service have deteriorated to a meagre correspondence bolstered by occasional gatherings over food and drink where previous hells become "the good old days." However, when ex-shipmates William Bordner and Ernest Conway sit down over a drink, their conversation usually concerns the Bocon Chemical Corp. to which the former (vice-president) has contributed his formula for mothproofing wool; the latter (president), his advertising and sales experience; and each, part of his name.

$1000 and a Formula

For an organization that has been in existence less than two years, they have plenty to talk about. Conway immediately saw the possibilities in a material which Bordner, a chemist, had been developing over a period of twelve years. With $1000 they incorporated. Instead of immediately rushing out and selling it to the average housewife anxious to protect her woolens, they sweated out a period of testing until they were satisfied that their product, appropriately named Boconize, was as good as first thought. The purpose of this was two-fold: they didn't want careless home application to ruin the product's name, and they were initially, at least, after a different market, the woolen mills.

Boconize, which is available in two forms, a liquid (patent applied for January 2, 1947) and a paste (patent applied for March 6, 1947), combines with the disulfide linkage in animal fiber to render it unpalatable to the moth larvae that cause damage. It acts chemically as an acid salt of an aromatic amine. The liquid concentrate is a mixture of aliphatic and aromatic amines and amides and complex organic halogen acid. The active ingredient is said to be hydrofluosilic acid (certainly nothing new in the mothproofing business.)

Among the advantages claimed for the product are durability beyond anything yet developed for this purpose (United States Testing Co., Inc., verifies that it withstands a minimum of 5 washings and 25 dry cleanings); absence of color or odor; resistance to light, heat, perspiration, or salt water; no harmful effect on fabrics

ERNEST CONWAY: He wants to Boconize your suit.

or dyes used on protein fibers; and adaptability to spray, padding, or exhaustion application.

The Other Side

While most of those in the field who have watched the sudden rise of Bocon grant that the product is good, they take issue with the idea that it is something radically new. They point to certain "colorless dyes" such as the Eulans which combine with wool fibers to give permanent moth protection. Others feel that Boconize is effective in mill applications where the cloth or yarn is in intimate contact with it in a hot bath for a relatively long time, but that the same results are not obtainable in spray applications. An entirely different angle is the opinion that the solution to the moth problem is a spray that can be used in the home to give protection for a reasonable time.

Conway's answer is to point to the laboratory results and to the opposition he has already overcome in the textile mills where the bad name of mothproofing compounds has made them the traditional scapegoat for any bad runs. Mills that previously refused to test Boconize now are anxious to do so in order not to lose the competitive advantage of selling a mothproofed article.

Sales Sights & Set-Up

The Perkins Soap Co. of Springfield, Mass. is the distributor of Boconize for New England and New York, and Rohm & Haas has been appointed to handle sales to mills throughout the rest of the United States. In its rented facilities in the Bronx, New York, Bocon produced about 55,000 pounds during the first four months of the year. Contracted sales based on the results of trial runs may run over 700,000 pounds for this year.

In April, the Residex Corp. of Newark, N. J. became Bocon's link with the pest control industry. Residex formulates Boconize into a compound sold as "Resiproofer" to exterminators for home application. Rohm & Haas will handle sales of the paste to the distributors to be sold under their own trade names.

The Name's the Thing....

The name Boconize will not follow Bocon into these other fields; but it will be retained for mothproofing done in the mills. Conway expects to launch an all-out campaign to arouse consumer demand for mothproofed fabrics. (With Boconize at $1.50 a pound, he figures this will add 15 cents to the cost of a suit.) When he has the consumer educated, he is betting the shouting will not be for mothproofing, but for "Boconizing."

HOT AIR PLASMA

Sterile spray technique developed abroad claims cheaper drying of plasma, penicillin.

THE DRYING of blood plasma has been one of the most difficult problems the chemical engineer has been called upon to solve. Blood is an ideal growth medium for bacteria, so complete sterility is an absolute essential.

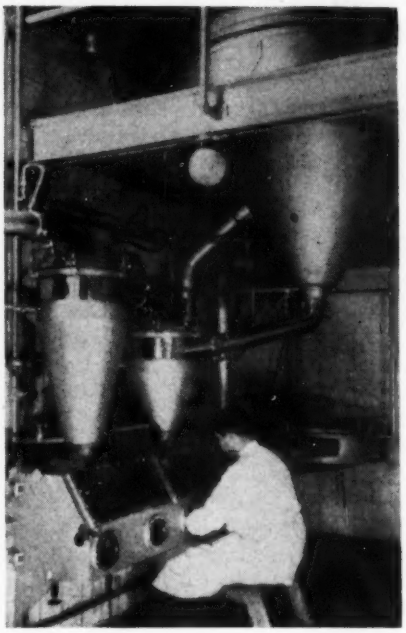
In the United States the solution to this problem has been the use of the so-called freeze-dry technique. In this procedure, the blood is frozen and the water evaporated from the ice crystals under high vacuum.

Hot Air & Spray

In 1939 in Denmark, however, the cooperation of the Danish Serum Institute at Copenhagen and A/S Niro Atomizer resulted in the development of a spray drying technique which has operated satisfactorily since then.

The dryer used was an adaptation of one of the regular Niro dryers to sterile operation. The dryer operates under a slight positive pressure to prevent leakage into the system, the water being removed by a current of warm air which has been filtered and sterilized. Initial sterilization of the equipment is accomplished by live steam. Dr. Kurt Ladenburg of Technical Enterprises, Inc., New York, who is familiar with both systems, states without reservation, "The cost of producing plasma or penicillin via spray drying is much les than by present methods used in the United States."

Sterile handling of the powdered product is acomplished by discharging it from the dryer into a sterile cabinet equipped with hand holes (see illustration). There



PLASMA DRYER: . . . no ice.

the material can be packaged manually or semi-automatically in the closed sterile system.

Penicillin, Too

In Sweden, Kaernbolaget during the war independently converted a Niro spray dryer to the drying of plasma, utilizing essentially the same technique. This unit was later converted to the production of penicillin powder. As yet, penicillin produced in this plant is used only orally. Production of a product sufficiently sterile for use by injection is expected to follow.

HEAT EXCHANGER

THE HIGH specific heat and antifreezability of an ethylene glycol-water mixture are utilized in this application of heat-exchange principles to human comfort. The antifreeze mixture is permanently sealed in a Vinylite bag. Placed in a refrigerator the liquid congeals to a semi-solid state at a temperature well below 0°C.; placed in a pan of boiling water, the bag becomes a hot water bottle. The liquid will stay hot or cold for a considerable period, and the vinyl film is light enough to provide sufficient conduction.

ROOM FOR RESEARCH

FROM THE hullaballoo that the word "research" has created over the past few years, it would seem that all companies have their own laboratories by now. That they don't is evidenced by data cited by T. A. Boyd, ASTM president and a research consultant for General Motors.

There are more than 17,000 manufacturers with a gross income above $500,000. Only about 2500 have laboratories, employing about 135,000 people.

A stock excuse for this situation is that research is too costly and complicated. Also, the true importance of research is often deprecated. The error of this notion is countered by figures recently published by two major companies: Du Pont has stated that 46% of its gross sales in 1942 consisted of products which either did not exist in 1928 or were not then made in commercial quantities; and Johns-Manville Corp. in 1947 noted that 56% of its current sales were in products introduced since 1928.

ARE ENGINEERS HUMAN?

Two educators take engineers to task for deficiencies both in attitude and training.

ENGINEERS have been called everything, so it will not come as a surprise to them that George S. Speer, head of Illinois Institute of Technology's Institute for Psychological Services, has recently called them socially unconcerned "ivory-tower dwellers." A detailed study of psychological tests shows, he said, "shows that the engineer has an interest in social institutions and in the improvement of mankind, although he lacks a personal interest in people as individuals." The person who chooses engineering prefers to work with groups and in activities remote from the individual.

To prove his contention, Speer cited the results of tests given to freshman engineering students at Illinois Tech. Three-quarters of them stated that they would like working on a cancer cure, but would dislike reading to blind students; they would like to make toys for children, but would dislike telling them stories; they would like to study criminology but dislike welfare work; like purchasing supplies for a picnic, dislike persuading people to attend.

Social awareness was found to increase with age and experience, but in order to develop it earlier Speer suggested that engineering colleges put more stress on studies involving personal relationships.

Overeducated and Undereducated

Dean James K. Finch of Columbia's School of Engineering is worried less about engineers' personalities than their formal education. Many of the tens of thousands of young men being turned out by America's engineering schools, he says, are educated either beyond their capacities or below the top needs of their profession.

Commenting on the growing demand for more effective general engineering education, he says, "While the engineer may not care to become an economic expert, a social scientist or a politician, it is clear that he must be prepared to advise and guide in those activities . . ."

FINCH AND SPEER: For engineers, Mother Goose and Malthus.

STANTON CHEMICALS

A new firm prepares to exploit Texas petroleum.

CONSTRUCTION work is well advanced on the Corpus Christi plant of Stanton Chemicals, Inc., and initial production from the first operating units is scheduled for late Fall.

Headed by Robert E. Stanton, consulting engineer of Denver, Colo., the company will produce aromatic-type hydrocarbons and their derivatives, including benzene, toluene, xylene, naphthalene, anthracene, anthraquinone, and phthalic anhydride. The present installation will have a capacity of 50 tons of finished products a day, and after processes have been worked out, capacity will be quadrupled.

More ambitious plans are on the docket for the future: the company plans to build at least one additional plant, in the Rocky Mountain area, and to produce a variety of products by halogenation, nitration, and oxidation of hydrocarbon compounds.

Stanton has made contracts to assure raw material supplies; and loading facilities now being built will provide for shipping by rail or boat.

RESIN SPECTRUM

Four new ion-exchange resins cover wide range of requirements, extend utility of process.

NO, THE little white spheres at the left are not tennis balls. They are particles, magnified 60 times, of a new, bead-form, synthetic ion-exchange resin—one of four just introduced by Resinous Products & Chemical Co. These four, together with the two previously made and sold by the company, are claimed to provide the whole orchestra—from double-bass to piccolo—necessary to play the complicated score of ion-exchange requirements.

Sands to Synthetics

To be seen in its proper perspective, the current development must be viewed against the backdrop of ion-exchange history—and that history is one of continuous progression from the specific to the general, from the isolated conjunction of fortuitous circumstances under which the older ion-exchangers could work to the generalized application of the new and versatile tool in adsorption separations (CI, May, 1948, page 754).

Inorganic zeolite gels were used for water treatment as early as 1905, and several years later it was discovered that the naturally-occurring greensands are more durable, though of lower capacity. These materials replace "hardness" ions with sodium; but complete demineralization, an obviously desirable extension of the principle, requires replacement with hydrogen. Treatment of the materials with acid (to replace sodium with hydrogen) breaks down the silicate structure.

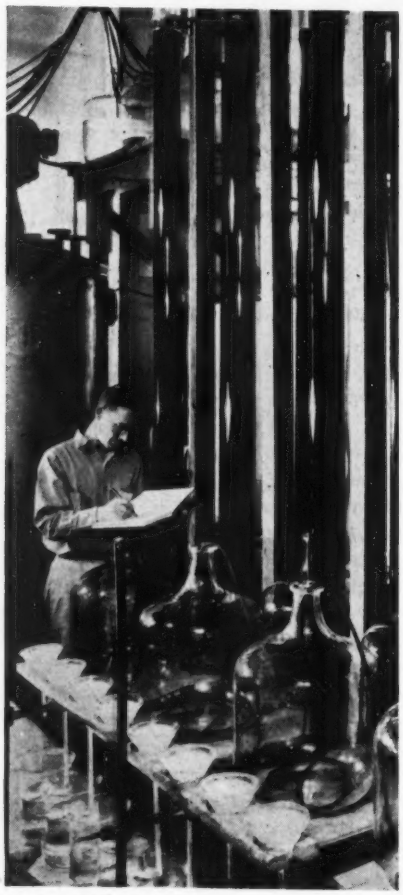
Search for a more durable "hydrogen exchanger" led to the development, about 1930, of sulfonated coal exchangers. Their initial cost is low, their capacity is moderately high, but they tend to disintegrate and throw off color at high pH and high temperature.

The Year That Counted

The year 1935 divides medieval from modern history: it was then that two English chemists, Adams and Holmes, discovered the cation-exchanging ability of phenolic and sulfonated resins. Moreover, they found that basic resins containing amino groups will replace anions with hydroxyls. Thus, water could be completely demineralized.

Resinous Products' first cation exchanger, Amberlite IR-100, worked well only in acid or neutral solutions and had a moderate capacity: 800 milliequivalents, in the calcium-sodium cycle, per kilogram of wet resin (compared with 800 for sulfonated coal, 400-500 for greensand).

The new sulfonic acid-type Amberlites, IR-105 and IR-120, have capacities of 1200 and 1900 meq./kg., respectively. Both of them are produced in bead form for better resistance to attrition. The



ION EXCHANGE: New instruments for the orchestra.

latter material, moreover, is effective over the whole PH range; and because of its extremely high capacity, its use in recovering valuable metals from plating, rayon-spinning, and photographic waste solutions should prove economically attractive. The engineer will choose among IR-105, IR-120, and the older IR-100, depending on the conditions of use in his particular process.

Weak Acid Type

Amberlite IRC-50 is a cation exchanger of the carboxylic-acid type. Because it produces low concentrations of acid, its use is desirable for the treatment of acid-sensitive materials. It can be regenerated to the acid form with very high efficiency. It is produced in the form of white beads (as shown in the illustration).

A new anion exchanger, Amberlite IRA-400, is practically an "insoluble caustic." It is so alkaline that it can split neutral salts.

New Techniques Possible

A recounting of the resins' properties is only half the story. While they can be used in the conventional way, they can also be handled quite unconventionally to achieve rather startling results.

Previously, cations had to be exchanged first (yielding acids) and then the anions (yielding water). This was tough on acid-sensitive materials like sugar syrups and proteins. Now, by using the strongly basic, salt-splitting exchanger, IRA-400, the engineer has a choice between conventional and reverse deionization. In the latter procedure, the anions are exchanged first (yielding bases) and the cations last.

Also, the physical and chemical properties of IRA-400 and IR-120 are such that they can be mixed in one bed for one-step deionization. Both operate over a wide pH range, and since they are of different densities they can be hydraulically separated for regeneration.

Learning the One-Step

A possible outgrowth of mixed-bed operation is continuous ion-exchange processing. A mixture of fresh resins would flow to the process and do its work, whereafter it would be hydraulically classified into its two components, each of which would be regenerated, and the resins would again be mixed and returned to the process.

The carboxylic-acid resin, IRC-50, can be buffered to any desired degree of ion absorption. It is thus possible to fractionate the amino acids in a protein hydrolysate. Eventually it may be economically feasible to remove a particular amino acid from a protein abundant in it, and "fortify" a protein foodstuff deficient in it.

Alkaloid Recovery

The weak-acid character of IRC-50 makes it much easier, too, to recover sensitive amino acids, alkaloids, and antibiotics from the resin. Former exchangers held compounds so strongly that they were partially destroyed upon regeneration, or so much acid was required that the solutions were extremely dilute.

These are only a few of the possible applications, of course, in the pharmaceutical, biochemical, and general chemical processing fields.

How Much, How Soon?

Now for the $64 question: How much will they cost? The resins are relatively expensive, but on a cost-per-capacity basis, they are in the same range as current materials. Because of their high resistance to chemicals and attrition, they can be expected to last longer in service, reducing the cost still further.

The availability is the $32 question. All of them are on hand in sufficient quantity for preliminary trials, and all will be in commercial production within a few months.

CHEMI-CURLS

Lawsuits in the permanent wave business reveal there's more in women's hair than meets the eye.

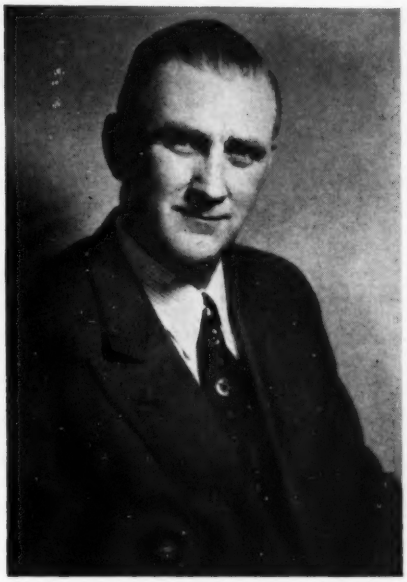
WHETHER a chemist pays thirty dollars or two bucks for the curl in his wife's hair, or is still a happy bachelor, he can rightly survey fair tresses with professional interest. A federal court has ruled that Helene Curtis Industries, Inc. has violated the patents of Sales Affiliates, Inc. covering the presently marketed means of machineless permanent waving, and the damages are expected to be in excess of $1 million. Since this industry is estimated to be in the $250 million class, and chemicals impart the curl, one can take a chance on staring.

Hot Stuff

Machine waves, which curl by heat from electric current, have about 25% of the market; machineless, 35%; and cold waves, 40%. The machineless waves depend on heat generated by chemicals, and they apparently are pretty good, for one-quarter to one-half million heat units are sold each year. Only about 5% of these depend upon the reaction between a polyhydroxy alcohol (usually glycerine) and potassium permanganate for heat generation, yet this is probably the biggest use for permanganate. The other 95% contain different oxidation-reduction mixtures. About 1-1½ million pounds of chlorates (sodium and potassium) per year and 2 million pounds of aluminum grindings go into these kits. Other materials that complete the formula are catalysts (mainly copper oxide), ½ million pounds per year; weak acids or acid salts (such a maleic, tartaric, or copper sulfate), ½ million pounds a year; and fillers (talc, diatomaceous earths, etc.), 7 million pounds a year.

Winkel's Patent

The original patent on this method is that of Fred M. Winkel, who depended



McDONOUGH AND EVANS: Their waves don't crimp your pocketbook.

on heat of neutralization for his effect. R. L. Evans and E. G. McDonough eliminated the chemical shortcomings of the original waving pads. The patents of these men were the ones just upheld.

Cold Number

Evans is also the inventor of the so-called "cold" permanent wave as now practiced. Although this method is currently enjoying much popularity, it is not big as a market for chemicals. One-quarter to one-half million pounds of mercaptans (generally thioglycolic acid) are used each year, while 1 million pounds of bromate are employed as the neutralizer (hydrogen peroxide can be substituted).

Despite much screaming in the beauty parlor business about loss of trade to home kits, the actual effect has been to lower the price of a permanent wave in a shop, not to lower the number sold. Trade estimates place the number of permanents at 80-100 million a year. With either the machine or machineless hot waves, the hair is pre-treated with solutions that have varied in composition from ammonia to sodium sulfite. These preparations, now usually mixtures of alkaline salts and sulfites, take millions of pounds of these materials. More waves are being sold, with a peak of 300-400 million expected. That will quadruple the present chemical requirements.

HARDENING STEEL

THE NATIONAL Emergency Steel Specifications will continue in use, even with the greater availability of alloying materials, according to E. C. Bain of the Carnegie-Illinois Steel Corp. These specifications were one result of the pre-World War II systematic fundamental study of the real effects of alloying elements upon steel, which showed that the maximum-size piece which could be fully hardened and tempered was greater when a little of several alloying elements was used rather than a great deal of a single element.

It is probable that future research will be directed toward securing hardenability with minimum use of none-too-plentiful alloying elements. However, a sharp outlook will be maintained for addition agents with a great capacity for promoting deep hardening. This is accomplished to a certain extent by the addition of exceedingly small amounts of boron. Weight savings can be made by utilizing such steels at still higher strengths where great ductility is not required.

HOT PLANTS

Isotope studies may revolutionize fertilizer application techniques.

THE FERTILIZER industry can be prepared for some changes as a result of experiments being conducted by U. S. Department of Agriculture laboratories in cooperation with various state extension divisions.

Radiophosphorus has been used to study the utilization of phosphate fertilizers. It was found that potatoes, for example, take up phosphorus during their entire growth period; but cotton, tobacco, and corn use it only in the early growth stages. When the latter three crops are grown in soil that is naturally phosphorus-rich, they prefer the natural phosphorus to fertilizer phosphorus; but potatoes don't care one way or the other.

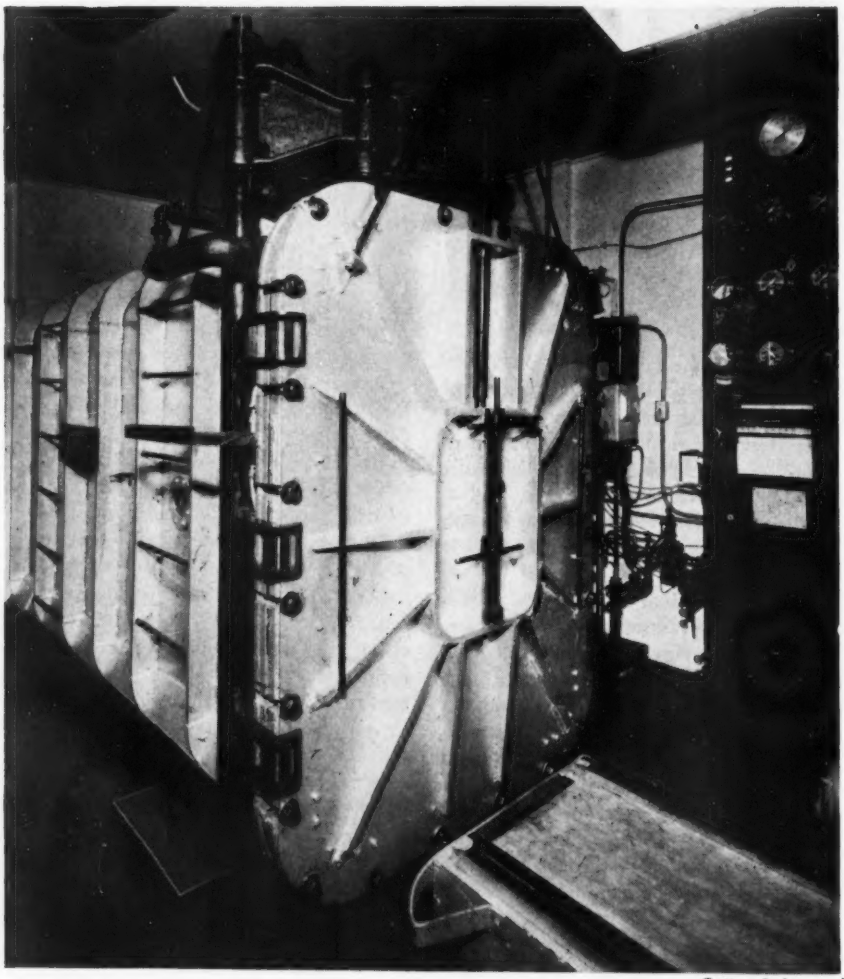
Isotope research is giving scientists clearer insight into the role of the trace elements. It has been known that animals grazing on cobalt-deficient land will come down with a deficiency-induced anemia, but not until experiments were conducted using radio-cobalt was it known that the element must be present continuously; i.e. a reserve is not stored in the animal's body.

Does radioactivity *per se* stimulate or retard plant growth? Russian scientists claim spectacular growth increase of radio-isotope-treated plants, but U. S. scientists, who have made preliminary investigations, are skeptical. If Russian claims are supported by further experiments, isotopes will have a job cut out for them. In any event, the "atomic age" will bring about some major changes in a science that was already old when Indians buried a fish under each corn-hill.

PRIZE COTTON CROP: Farmers will learn their alpha, beta, gammas.

SUBLIMATION: Its Applications

by C. R. WILKE, Chemical Engineering Division, College of Chemistry,



Cutter Laboratories

Temperature sensitive materials such as blood plasma, penicillin and streptomycin are being dried commercially by sublimation in large vacuum chambers like the above.

SUBLIMATION figures importantly in several modern chemical processes, but there is much need for more fundamental data necessary to accurate design of equipment.

ALTHOUGH it has been used since the time of the alchemists, sublimation has received little direct attention in the recent literature of chemical technology. There have, however, been several recent developments in its use in the chemical processing industries. This article attempts to summarize the current status of sublimation as a chemical unit operation and describe briefly some of its more recent industrial applications.

WHAT IT IS

Sublimation is usually defined as the transformation of a solid to a vapor, followed by condensation to the solid state without passing through an intermediate liquid phase. In practice, many sublimation processes do not follow this definition exactly. For example, when possible the solid may be liquefied during vaporization to facilitate heat transfer into the material. A relatively recent application, drying by sublimation, does not require a condensation step in certain types of operation, as the vapor is not wanted.

Sublimation is generally applicable when a separation of materials may be obtained by vaporization, and properties of the materials are such that distillation is not feasible. Such materials fall into two general groups: (1) unstable or sensitive materials unable to withstand the higher temperatures required for vaporization from the liquid state, and (2) high melting materials which are difficult to liquefy in ordinary materials of construction.

Sublimation is also useful in other instances depending upon particular circumstances. It is sometimes possible to separate a substance from non-volatile impurities in a single operation and obtain the desired product in an attractive physical form. In other cases the fine crystals obtained by sublimation are preferred to the solid cake which would be obtained by solidification of the material from the liquid state.

PHASE EQUILIBRIA

Some of the basic principles of sublimation may be illustrated by consideration of the phase diagram for the material, such as is shown for water in Fig. 1. Curves TC and AT represent the vapor pressures of liquid water and solid ice respectively. BT represents the effect of pressure on the melting point, which is of negligible importance in the range of pressures used in sublimation processes. The area below the curve ATC represents the range of conditions under which vapor alone can exist. Solid and vapor are in equilibrium along AT, and liquid and vapor along TC. At the invariant point T, designated as the "triple point", all three states of matter can coexist.

The realm of sublimation lies in the range of vapor pressures and temperatures below the triple point. If vapor at a pressure (or partial pressure) below the triple point is cooled sufficiently, direct condensation to the solid form will result. Referring to Fig. 1, if air at 20° C. containing water vapor at 3mm. partial pressure is progressively cooled, ice

In Chemical Processing

University of California, Berkeley, Cal.

will first form at −5.7° C. With further cooling crystallization of ice will continue and the composition of the air will vary along line AT. These conditions are similar to those under which hoar frost is formed on the earth's surface. Flowers of sulfur are similarly formed by direct condensation of vapor on a cold surface with the pressure maintained below the triple point value.

Again on the basis of Fig. 1, a piece of solid ice subjected to vacuum at −10° C. will vaporize spontaneously when the pressure is reduced to 2.15 mm. As long as the temperature of the solid and vapor in equilibrium with it are maintained at a temperature below the triple point value, all phase changes resulting from changes in temperature or pressure will result in direct conversion of solid to vapor or vice versa. Equilibrium concentrations of saturated vapor are readily obtained from the vapor pressure-temperature curve for the solid.

HEAT OF SUBLIMATION

In the vaporization of solids, as in the vaporization of liquids, heat is absorbed. The heat of sublimation of a solid is approximately equal to the sum of the latent heat of vaporization and heat of fusion of the liquid, both extrapolated to the sublimation temperature. Heats of sublimation may be calculated rigorously from the vapor pressure curve of the solid using the Clapeyron equation or estimated by various methods.[1] This heat must correspondingly be removed in condensation of the vapor. Because of the relatively low temperatures used in sublimation processes, and difficulty in obtaining good heat transfer to solids, supply and removal of the heat of sublimation is frequently the most difficult requirement to be met in the design of sublimation equipment.

EVAPORATION OF SOLIDS

The partial pressure of vapor at the surface of a solid is usually considered to be the equilibrium vapor pressure of the solid at the temperature of the surface. If the partial pressure of vapor at some point removed from the surface is reduced to a value lower than the equilibrium pressure, spontaneous movement of vapor to the region of lower partial pressure will result. As evaporation proceeds heat must be supplied to the solid in order to maintain the surface temperature and corresponding vapor pressure of the solid high enough to effect vaporization at an appreciable rate. If no heat were supplied to the solid it would cool until its vapor pressure equalled the partial pressure of vapor in the surrounding gas phase. Conversely, if heat is supplied at a rate greater than that necessary to effect vaporization, the temperature will rise to the triple point value resulting in melting of the solid. In its simplest form a sublimation process requires a vaporizer where heat is supplied to the material and a cooled condenser connected to the vaporizer. A process classification may be based upon the methods used to effect vaporization.

Simple Sublimation. In "simple sublimation" a vapor partial pressure gradient is established between the surfaces of the solid in the vaporizer and in the condenser. In general the rate of evaporation is proportional to this partial pressure difference. The mechanism of vapor movement is determined by the manner in which the partial pressure difference between the vaporizer and condenser is maintained.

Simple sublimation at atmospheric pressure may be conducted by maintaining an effectively lower temperature at the surface of the solid in the condenser than is maintained in the vaporizer. Under these conditions vapor movement occurs by diffusion of vapor through the inert gas in the apparatus, aided to some degree

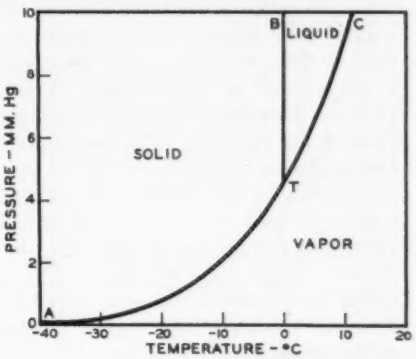
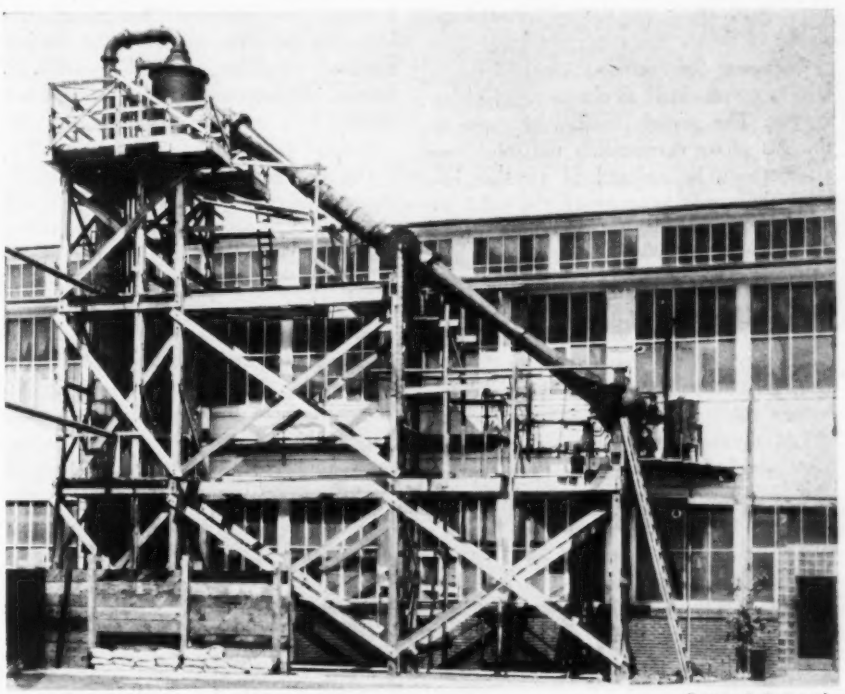


Fig. 1—Vapor pressures of water.

by thermal convection currents established between the vaporizer and condenser. For a given vapor and inert gas, the rate of diffusion varies directly with the difference in vapor pressures at the surfaces of the solid in the vaporizer and in the condenser, inversely with the distance between the vaporizer and con-



Cutter Laboratories

This giant steam ejector, one of the largest ever built, is used to obtain the high vacuum required for sublimation drying of blood plasma at Cutter Laboratories, Berkeley, Calif.

[1] For a review of methods for estimation of latent heats see Hougen, O.A. and Watson, K.M., Chemical Process Principles I, Chapter VII, Wiley and Sons, Inc., New York (1943).

denser and inversely with the partial pressure of inert gas in the apparatus.[2]

The effects of these variables make it desirable to conduct this type of operation with the vaporizer temperature as high as possible and with the shortest practicable distance between the vaporizer and condenser.

VACUUM AIDS OPERATION

Movement of vapor in simple sublimation may be accelerated by operation under vacuum. If the total pressure on the solid in the vaporizer is reduced to a value below its vapor pressure by evacuating the apparatus through the condenser, spontaneous evolution of vapor occurs analogous to the boiling of a liquid. At moderate vacuums the ordinary laws of fluid flow are applicable and the rate of flow of vapor to the condenser is proportional to the difference in total pressure maintained between these two parts of the apparatus. The vacuum and the condenser temperature must be controlled so that the pressure in the condenser is equal to, or greater than, the vapor pressure of the solid at the condenser temperature; higher vacuum would serve only to vaporize the solid from the condenser and prevent further condensation.

At extremely high vacuums, of the order of 10^{-6} mm., vaporization occurs by molecular effusion. This case is analogous to molecular distillation and the special theory and techniques developed for this field are applicable. Operation in this pressure range is of fairly limited applicability. It is useful for the purification of certain high molecular weight organic compounds and as an analytical tool, particularly in the pharmaceutical field.[3]

Entrainer Sublimation. Vacuum operation is not essential to obtain rapid vaporization. The partial pressure of vapor in the gas phase surrounding the solid may alternatively be reduced to a value less than the vapor pressure of the solid by passing an inert gas, commonly air or steam, over or through the solid in the vaporizer. Evaporation of the solid then occurs by diffusion of vapor into the inert gas stream, analogous to the transfer of water vapor in the drying of solids. This type of evaporation characterizes "entrainer sublimation." By passing the gas stream through the solid in a pulverized or subdivided state, rapid rates of evaporation may be obtained as a result of the extended surface of the subdivided material.

The equilibrium relationships for this type of operation are analogous to those for steam distillation or drying, Dalton's law usually being applicable. Calculation of evaporation rates assuming saturation of the entrainer gas with vapor are, therefore, simple and straightforward. The necessary relations for prediction of the degree of saturation of entrainer are not generally available. It is possible to utilize the theory of drying in the constant rate period in some instances[4].

Heat Transfer Considerations. The design of vaporizers for sublimation is usually based upon heat transfer requirements. There seems to be little standardization in vaporizer design as the requirements for each process may vary widely, depending upon the materials involved.

When possible, it is desirable to liquefy the solid in the vaporizer to improve heat transfer. In this case the vapor pressure must be reduced to a value below the triple point in the condenser either by use of an entrainer gas or as a result of the normal pressure drop between the vaporizer and condenser. Care must be taken to prevent premature condensation of vapor in the ducts leading from the vaporizer. If the vaporizer is direct-fired these ducts may be heated by the combustion gases. Lines may also be traced with steam or other heating media. In entrainer sublimation the slight superheating of the vapor necessary to prevent premature condensation may be obtained by control of the entrainer gas temperature.

Heat transfer to solids may be improved in direct-fired or jacketed vaporizers by use of scrapers to improve contact of the solid with the heat transfer surface. When feasible, good heat transfer may be obtained by blowing a hot entrainer gas through the solid in granular form. In this case, part or all of the heat required may be supplied by the entrainer. Arrangement of the solid in subdivided form on trays is effective in some instances.

High vacuum operation presents the greatest difficulty because of the low conductivity of the vapor space surrounding the solid. Induction heating by use of high frequency electric currents is useful in some cases, particularly for the attainment of high temperatures. Induction heating has the added advantage of making possible lower temperatures at the outside surfaces of the vaporizer; an effect particularly desirable in applications where corrosion of the vaporizer body, or physical deformation under vacuum may result from high temperatures.

The necessary requirements for condensation are that the partial pressure of vapor in the gas phase exceed by some amount the equilibrium vapor pressure of the solid at the temperature of the system, and that conditions be suitable for formation and growth of crystal nuclei. Little quantitative information applicable to condenser design is presently available in the literature, particularly with respect to prediction of rates of crystallization, crystal size, shape and orientation.

The nature of the crystals obtained in sublimation is frequently characteristic of the particular materials involved, the condenser design, and convection currents in the apparatus. Condensation of a relatively pure vapor, such as in simple vacuum sublimation, often leads to the formation of hard crystals which agglomerate on the condenser surfaces. This incrustation impedes heat transfer in further condensation, so that for most rapid condensation it is necessary to provide scrapers or other facilities to keep condenser surfaces clean. The cake so obtained must frequently be pulverized into a form more suitable for use.

Condensation of vapor from an inert gas may often result in crystal formation in the gas phase, rather than directly on the condenser surfaces, with the formation of powder or snow-like crystals. This is particularly characteristic of entrainer sublimation and simple sublimation at atmospheric pressure. Operation at low inert gas partial pressures or extremely low condenser temperatures, however, favors crystallization on the condenser walls with cake formation.

If the solid is formed near its melting point the particles may soften and agglomerate.

In condenser operation, therefore, it is desirable to operate at as low a temperature as is required to obtain adequate flow of vapor from the vaporizer, and yet to maintain the temperature sufficiently high to obtain the solid product in as nearly the desired physical form as possible.

Sublimation condensers vary in design depending upon the nature of the system. Surface condensers in the form of large air-cooled chambers are used for many operations. These may be equipped with swinging weights or ram rods to keep the condensing surfaces free of solid. Tubular condensers with rotary scrapers are also used.

In entrainer sublimation it is sometimes feasible to quench the gas stream with a liquid in which the solid is insoluble, and recover the product by filtration. A cold gas stream may also serve as a quenching medium, although product recovery may be difficult.

FRACTIONAL SUBLIMATION

Fractionation of two or more materials may be obtained if their vapor pressures are well differentiated. Fractional sublimation is generally less successful than

[2] For a pertinent discussion of diffusion of vapors see Sherwood, T. K., Absorption and Extraction, Chapter I, McGraw-Hill, Inc. New York (1937).

[3] See Hubacher, Max H., Ind. Eng. Chem. Anal. Ed. 15, 448 (1943).

[4] The generalized mass transfer relations for through-circulation drying are applicable for the case when the entrainer is passed through the solid in granular form. See Wilke, C. R. and Hougen, O. A., Trans. Am. Inst. Chem. Engrs. 41, 445 (1945).

fractional distillation since rectification is not possible. Preferential vaporization may be obtained by progressively raising the vaporizer temperature as sublimation proceeds. Preferential condensation may be obtained by passing the mixed vapors through chambers maintained at progressively lower temperatures. Close temperature control is necessary.

APPLICATIONS

Some general types of sublimation operations are shown in Fig. 2. Additional principles and techniques may be illustrated by consideration of a number of typical industrial applications.

SIMPLE SUBLIMATION

An application of simple sublimation of long standing is the purification of iodine. Iodine has a vapor pressure of 114 mm. at its melting point (90.1°C), and hence is readily sublimed at atmospheric pressure. Crude iodine may be obtained by the reduction of sodium iodate in the mother liquors produced as a by-product of sodium nitrate crystallization from Chilean caliche. The crude product is obtained in the form of a wet cake containing 75-80% of iodine and 5% of salts. The cake is charged into cement-lined retorts and heated with direct fire for several days. The iodine and moisture pass over and are caught in earthenware pipes about 2 ft. in diameter and 4 ft. long (see Fig. 2a). Six to ten of these are connected by joints, packed with jute sacking and mud except for a few inches at the bottom. Water vapor condenses and runs out at the bottom of each joint, and the sublimed iodine forms crystals over the inner walls of the receivers. Impurities remain in the retort as ash. After cooling for several days the receivers are opened for iodine removal. The product is of about 99% purity, the remainder being largely moisture.

Representative of simple vacuum sublimation at high temperatures is the sub-

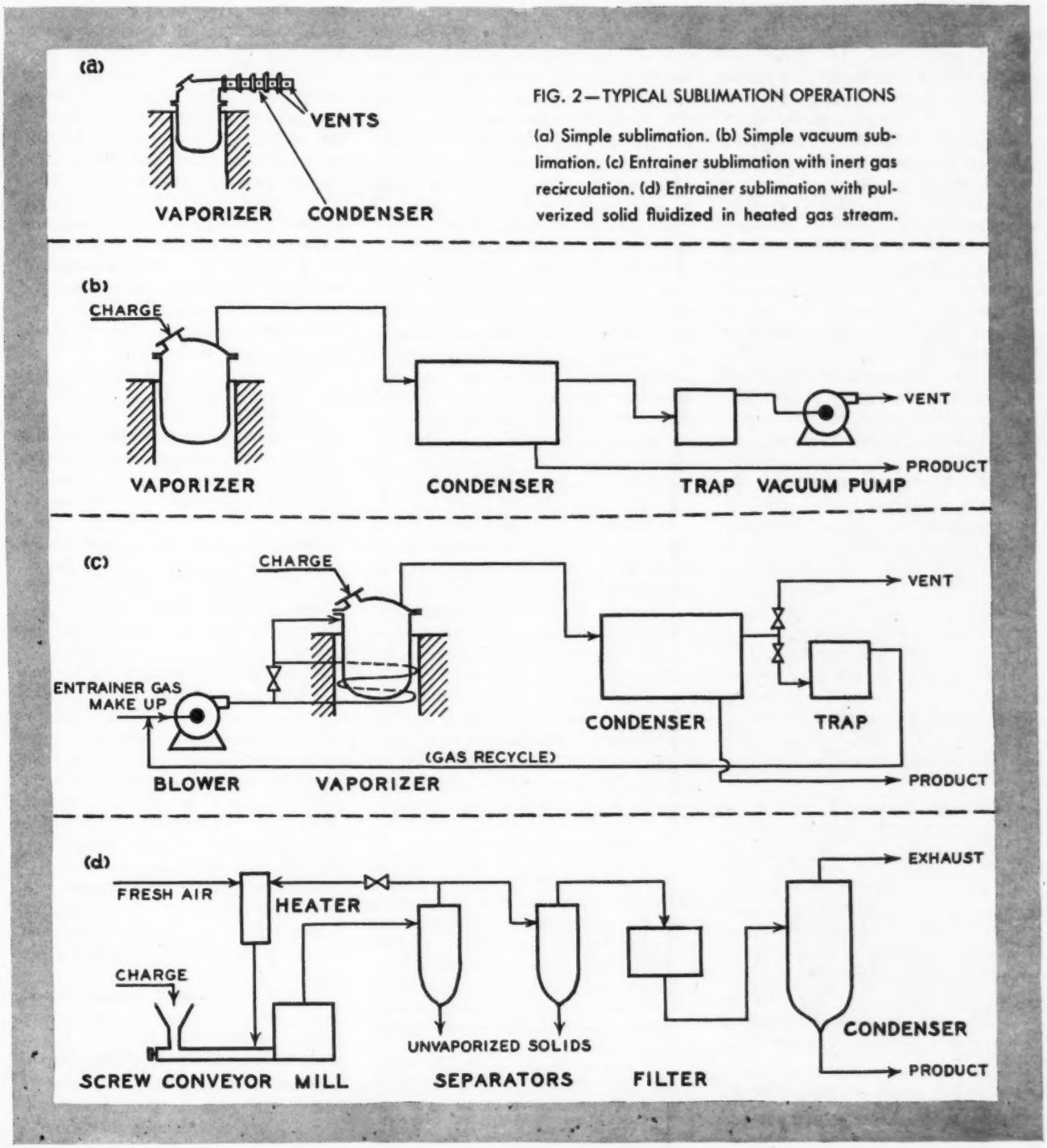


FIG. 2—TYPICAL SUBLIMATION OPERATIONS

(a) Simple sublimation. (b) Simple vacuum sublimation. (c) Entrainer sublimation with inert gas recirculation. (d) Entrainer sublimation with pulverized solid fluidized in heated gas stream.

limation of magnesium. This was conducted on a large scale during the war by Permanente Metals Corp., Permanente, California, in connection with magnesium production by the carbothermic process[5]. Metallic magnesium is obtained by reducing magnesia with carbon in electric furnaces. The reduction products, CO and magnesium vapor, issue continuously from the furnaces and are shock-chilled immediately by a continuous stream of natural gas. This produces a fine magnesium dust contaminated with about 20 per cent carbon and 30 percent MgO. The dust is collected in bag filters and incorporated into a paste with an asphalt-solvent mixture for charging into the sublimation retorts.

The retorts are vertical, cylindrical vessels 56 in. in diameter by 22 ft. high made of firebox iron. The crystal condenser consists of a cylindrical steel liner that extends from the top of the retort down 8 ft. The charge is loaded around a central core to maintain it against the walls for heat transfer. The retort is lowered into the furnace which is a brick lined vertical steel shell containing Nichrome resistance heaters. The pressure is reduced to approximately 3 mm. Hg in the heating space to prevent collapse of the hot retorts while operating under vacuum.

Solvent distillation and caking of the asphalt in the charge are first obtained by connection of the retorts to a central vacuum system consisting of two-stage Fuller rotary vacuum pumps. From 24 to 36 hours are required for this operation.

For the magnesium sublimation the retorts are heated to 800°C and connected to individual Kinney single-stage vacuum pumps operating at 100 cu. ft. per min., bringing the pressure down to 0.2 mm. Hg. The vapor pressure of magnesium is about 26 mm. at 800°C. For magnesium crystallization at 0.2 mm. of Hg. a condenser temperature of 500°C or lower is required. Sublimation proceeds for about 48 hours, yielding an average crystal ring weighing 2,200 lb.

The retorts are filled with hydrogen and then nitrogen for cooling and magnesium removal.

Magnesium sublimation, typical of similar operations at high temperatures and high vacuums, is characterized by high maintenance and operating costs. Retort life is relatively short as a result of corrosion and deformation under vacuum. Corrosion has been minimized by spraying the retorts to form an Al_2O_3 coating on exterior surfaces. Present indications are that for this process distillation may be more economically feasible than sublimation in future operations.

[5] For process details see Dungan, T. A., Am. Inst. of Mining and Met. Engrs., Technical Publication No. 1671, Metals Technology, Feb. (1944).

In some instances it is possible to form a product by chemical reaction and to obtain it in sufficiently pure form in a single step by sublimation from the reactor. This is characteristic of the production of calcium by the ferrosilicon process as employed by the New England Lime Co., Canaan, Connecticut, in the Defense Plant Corporation's magnesium unit[6]. Metallic calcium is formed by reduction of calcined limestone, largely CaO, with aluminum. The required quantities of CaO and Al in powdered form are mixed and briquetted for charging into retorts. The retorts are a 15% Ni, 28% Cr alloy in the form of cylinders 10 in. in diameter and 10 ft. long. They are heated indirectly in regenerative type automatic reversing furnaces fired with producer gas. Extending through the wall of the furnace are the cold ends in which the metal is condensed. These are 2 feet long with a water jacket extending back 12 in. from the face.

With the charge placed in the hot end, the retorts are exhausted to about 400 microns pressure with mechanical pumps. A glass filter in the line between the retorts and pumps serves to remove entrained dust. The mechanical pumps are provided with an oil seal by means of a continuous supply of circulating oil. Oil from the return line is filtered and dried before recirculation. Chemical reaction and sublimation of the calcium formed proceed as the retorts are evacuated. When the 400 micron level is reached the retorts are connected to mercury diffusion pumps to reduce the pressure to 20 microns. From 8 to 24 hours are required for completion of the process at a furnace temperature of about 2,200°F.

A preferential deposition of impurities occurs in the cold end, facilitating removal of pure calcium. Baffle plates in the cold end of the retort effect selective condensation of low boiling sodium and potassium. Magnesium and zinc tend to vaporize in the early stages and concentrate at the interface between the deposited calcium and the condenser surface. The metal, upon cooling and removal from the condenser, is in the form of hollow cylinders with one end closed. A purity of from 98-99% calcium with a maximum of 1% magnesium is obtained.

DRYING BY SUBLIMATION

Drying by sublimation has advanced rapidly in connection with the preparation and preservation of medical products and foods[7]. Temperature sensitive or labile materials such as blood plasma, penicillin, and streptomycin may be dried without deterioration from the solid state. Antitoxin may be stored for long periods when dried by sublimation to low moisture content. Foods such as pineapple juice or orange juice may be dehydrated in the frozen state with preservation of the real qualities of the fresh product. Oxidizable substances may be dehydrated without deterioration at the high vacuums employed in sublimation drying. Dried raw beef keeps for years without refrigeration and may be easily reconstituted to yield a product indistinguishable from fresh meat.

The dessication of blood plasma as employed by the Cutter Laboratories, Berkeley, Calif., on a large scale during the war is representative of this type of drying. First the material is shell frozen in bottles and placed on stainless steel trays. These trays are loaded on a truck, the shelves of which are electrical resistance heat exchangers. When the truck is fully loaded it is pushed to a large dessication chamber. The door is sealed and vacuum is applied to the chamber by means of a steam ejector, reducing the pressure to about 200 microns. The temperature is initially about −20°C. Over a period of about four hours, during which about 75 per cent of the moisture is removed, the temperature rises to about 60° C. About forty hours are required to reduce the moisture to less than 1 per cent. After the cycle is complete the dried plasma is removed from the dessicator and sealed under vacuum.

ENTRAINER SUBLIMATION

Entrainer sublimation is more generally applicable than simple sublimation for large scale production of many materials. Among the advantages of this form of operation are (1) its adaptability to continuous processing, (2) attainment of rapid evaporation rates, and (3) formation of snow or a powder-like crystalline product. Widely varied equipment and different entrainer gases may be used depending upon the substance handled.

Benzanthrone is sublimed by blowing superheated steam through the subdivided material. The vapors pass to a vertical jacketed condenser equipped with a rotating scraper. The product drops from the condenser into a receiver. Oil or glycerol at 100°C is useful as a cooling medium in this type of application to give a dry sublimate directly without condensation of water vapor.

In the sublimation of anthracene with superheated steam the vapors are condensed with a cold water spray. The product is insoluble in water and easily recovered.

Inert gases, such as carbon dioxide and steam, are particularly useful as entrainers for oxidizable substances which would be attacked by air. When the entrainer gas is valuable it may be recirculated as shown in Fig. 2(c). Sali-

(*Continued on page* 122)

[6] For process details see Staub, P. H., Chem. and Met. Eng., 52, 94 August (1945).

[7] For a comprehensive discussion of this subject see Flosdorf, E. W., J. Chem. Ed. 22, 470 (1945).

Polyethylene Packaging For Chemicals

EDITORIAL STAFF REPORT

RELATIVE NEWCOMER to plastics field is solving chemical and cosmetic packaging problems as data on it grows.

Bakelite Corp.

Polyethylene has replaced wax for bottling highly corrosive hydrofluoric acid.

FOR some time users of polyethylene in the electrical, molding, and food packaging fields have been wondering what the vendors in the chemical industry buy one-half so precious as the plastic they sell. Other trades' enthusiasm has at last pervaded the parent industry: considerable research into its possibilities in packaging chemicals, drugs, and cosmetics is underway and an increasing number of applications is being made public.

Since first commercial production of polyethylene in 1943 (CI, February, 1947, pp. 219-221), its amazing combination of properties has broadened its scope: it has high dialectric strength, high chemical resistance, low moisture transmission, flexibility at low temperatures, and low specific gravity; it is odorless, tasteless, non-toxic, can be heat sealed, and requires no plasticizer.

CHEMICALS STAY CONTAINED

The Plax Corp., Hartford, Conn., has recently reported experiments on transmission of liquids through the extruded film. A simple permeability test was devised and permeabilities of 48 liquid chemicals were determined to weed out those whose rate of diffusion is too great to warrant expensive tests under actual packaging conditions. The method does not work for compounds containing halogens or nitrogen since they were found to be transmitted considerably faster than predicted. It was found that polyethylene is a much more efficient barrier against polar compounds than against non-polar liquids, and that a rough classification of the film as a barrier for a particular liquid is possible.

Further work gives promise of calculating the permeability of a liquid from physical data. The greater the polarity or the higher the boiling point of a liquid, the lower is the rate of transmission through the film. This rate increases with a rise in temperature of the liquid, and slow transmission liquids are more affected by temperature than fast ones. The liquid phase of a material is more permeable than the vapor phase.

Such activity in learning more about the properties of polyethylene pertinent to its packaging chemicals will add to the present uses. Its great chemical inertness earmarked it for hydrofluoric acid now shipped in bottles blown of it. Carboys of HCl, H_2SO_4, and HNO_3, as well as caustic, have caps with polyethylene liners featuring a self-vent. Anhydrous $CaCl_2$ is being shipped in drums lined with the film to keep the moisture out. Rubber chemicals such as magnesium oxide and carbon black come preweighed in bags of the film, and are charged, wrapping and all, into the Banbury mixer. The layflat tubing is being used for drum liners for packaging monochloroacetic acid and other corrosive powders. Polyethylene-lined drums are being tested for other chemicals, and caustic may eventually be shipped in wooden containers so lined.

The British antimalarial mepacrine is being packaged in it, while Cellulastic Corp. offers a whole line of vials and cosmetic jars with tips, sprays, and closures of the same material. Stopette, a new deoderant, takes advantage of its flexibility to make a dispenser that operates by squeezing the bottle. The Seaforth line of men's toiletries is bottled in this unbreakable material. For closures and applicators, it is in wide use because of inertness to the material contained, tight seal without liner, and toughness and flexibility. The containers have a frosty appearance resembling glass, and can be colored to distinguish a product.

PERMEABILITY OF POLAR MATERIALS *

(Laboratories of the Plax Corp., Hartford, Conn.)

Material	*Permeability gms/24 hr/100 sq. in. for film .001" thick (room temperature)*
ethylene glycol	0.02
2-nitro- 1-butanol	0.05
dimethyl phthalate	0.09
water	0.16
hydrogen peroxide 30%	0.33
formic acid 85%	0.48
Old Spice Cologne	0.60
n-octyl alcohol	0.68
phenol 94%	0.70
ethylene chlorohydrin	0.73
allyl alcohol	0.95
Auvergne Cologne	1.1
n-butyl alcohol	1.2
acetic anhydride	1.3
methyl alcohol	1.6
ethyl aceto acetate	1.8
nitroethane	2.0
nitromethane	2.1
aniline	2.4
nitrobenzene	2.6
glacial acetic acid	2.6
acetone	7.6
methyl ethyl ketone	15
ethyl acetate	21
propionaldehyde	25
dimethyl aniline	27
pyridine	29
acetyl chloride	38
mono chloro benzene	38
butyl acetate	40
o-dichloro benzene	59
ethylene chloride	79
dibutyl ether	200
diethyl ether	410
ethyl bromide	680
chloroform	720

*It is believed that most values can be reproduced to ±5—10% with this test under constant temperature conditions.

ROSY FUTURE

The two producers of polyethylene, Carbide and Carbon Chemicals Corp. and E. I. du Pont de Nemours & Co., Inc., see a rosy future for it in packaging chemicals. It will do some jobs better than wood, glass, and metal, and in combination with these, will do other jobs more cheaply than these materials alone. At present, capacity is behind demand, but the situation should improve when the Sabine, Texas expansion of Du Pont is completed later this year. Greater exploitation of the film in lining drums for such items as corrosive chemicals and adhesives (to permit easy and complete removal), and wooden and cardboard containers for a variety of chemicals can be expected.

The specific gravity of polyethylene, the lightest of the plastics, makes a pound of it go farther (and cheaper on a freight basis), and eventual lowering of price should give it consideration for packaging jobs traditionally served by other materials. If a liner can add 10 trips to the life of a drum, or permit the use of a cheap primary packaging material, it will pay for itself. Chemical companies are finding that out.

Synthetic Piezo Crystals Move Into Industry

by LEONARD KRAMER
New York University College of Engineering
University Heights, Bronx, N. Y.

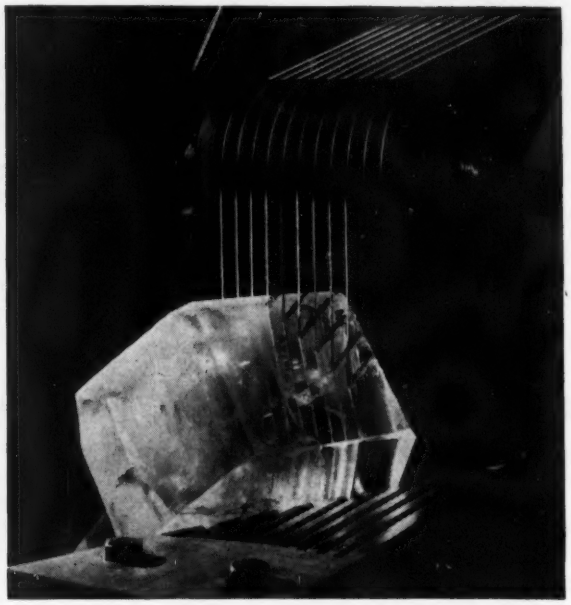


Fig. 1—Wet string saw cuts a crystal.

COMMERCIALLY GROWN CRYSTALS—first developed for war-time communications equipment—are replacing natural quartz crystals.

CRYSTALS are the latest naturally-occurring materials to feel the pressure of commercially produced synthetics. Natural quartz, long considered the irreplaceable crystal for oscillators, yielded some of its position to various artificially grown crystals during the war. Now work on growing artificial quartz crystals threatens to topple it completely.

Like many another war-time baby, crystal growing had been of only academic interest (for X-ray analysis) until World War II. Even before Pearl Harbor, it was clear that substitutes would have to be found to offset the shortage of high grade quartz, vital in fabricating oscillators for the high frequency electronic units of communication systems and aircraft detecting devices. Suitable replacements were found in Rochelle salts, ammonium dihydrogen phosphate (ADP), and (recently) ethylene diamine tartrate (EDT). However, since these did not occur naturally in large enough size or of suitable quality, methods of growing these crystals had to be developed. An indication of the success of this project is the present production of 60,000 crystals per year.

The prelminary search was limited to crystals that generate a current upon compression or release from compression, since only those displaying piezo-electric properties are usable in the electrical field. Originally, the crystal displaying the most suitable properties and affording a reasonably fast method of growth was ammonium dihydrogen phosphate. Because of its instability this has been replaced since the end of the war by ethylene diamine tartarate. The four phases in the commercial production of ADP crystals apply to both crystals, since they are grown by essentially the same method.

Based on the winning undergraduate paper presented before the Student Paper Contest of the New York Section of the American Institute of Chemical Engineers at New York University, April 24, 1948.

PURITY VITAL

In the initial step it is important to prepare a pure growing solution which will insure growth of the desired form of crystal. (Less than one per cent of urea changes the outside shape of an alum crystal from octahedral to cubic.) Only the chemically pure salt and distilled water are used. The salt is dissolved, usually at about 20° C., until saturation is complete. The temperature is then raised one or two degrees above saturation temperature to prevent deposition of crystal during processing. After filtration, the solution, maintained at the temperature slightly above saturation temperature, is ready for use as a growing solution, either for seeds or for the product, crystals.

GROWTH OF SEEDS

The growing solution is siphoned into a glass tank previously heated to the temperature of the solution. On top of this jar is placed a glass cover fitted with a stainless steel rod that can be rotated. After the jar is insulated with a felt blanket, the temperature of the solution is very gradually lowered. At the end of an approximately forty-eight hour period, when the steel rod is removed, a large disordered growth of imperfect crystals is attached to it. Though imperfect, these crystals still have the general shape desired. Breaking them off the rod provides the raw materials for the seeds.

These seed particles (Fig. 2—Step 1) are then cut into two sections with a wet string saw (Fig. 1). Ordinary cutting devices are ruled out for this operation because they produce shock and sudden localized temperature changes. The wet string saw, which acts by dissolving a very thin layer of the crystal, eliminates such undesirable effects. Moreover, the water on the string provides necessary cooling.

After cutting, the cap of the crystal is retained, while the rest of the crystal is redissolved to prepare more solution. Again by means of a wet string saw, the cap is grooved as indicated and wet pipe cleaners cut two holes into the groove (Fig. 2—Step 2). Into these holes are inserted plastic tubes.

Because of the time taken to grow sufficient caps for seeds by the method just described, ordinarily crystals which have already attained complete growth are cut into plates and used as seeds. The advantage of using seeds to obtain crystals is explained in the literature[1] as follows: "The planes which become the permanent faces of the crystal are those perpendicular to the directions in which the velocity of growth is least." Thus it is easily seen why, when the natural faces are cut off the crystal to prepare the seed, the rate of growth of the crystal in restoring those faces is very rapid in comparison with the growth of a normal crystal with ordered faces. Because of the nature of the rate and direction of growth (Fig. 3), the seeds attain the normal shape of the perfect crystal within 48 hours after being inserted into the growing solution. Once this crystal is obtained, the need for seed caps disappears.

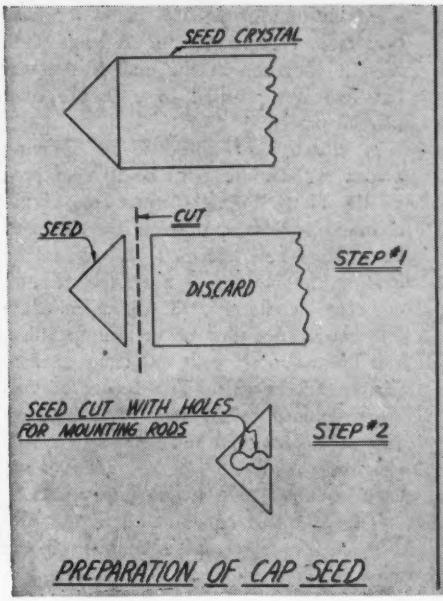


Fig. 2—Cutting and grooving the seed cap provide the nucleus for crystal growth.

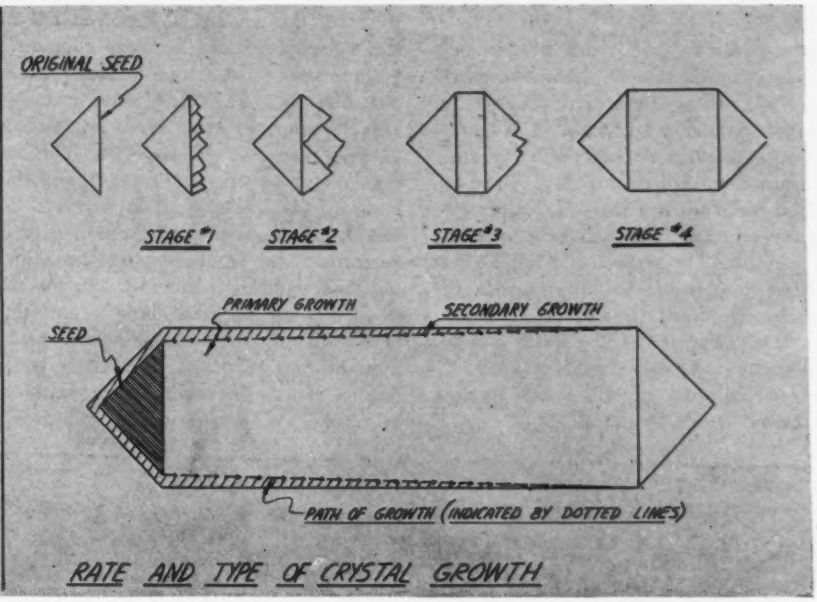


Fig. 3—Rate of growth of tre crystal in restoring natural faces cut off to prepare the seed is great enough for a perfect crystal to form in 48 hours.

CRYSTALS FROM SEEDS

The next is the actual production of crystals from these seeds. For ADP crystal culture, a supersaturated solution of the salt is circulated over the seed crystals. With a gradual lowering of temperature, the salt deposits out of the solution and onto the seeds. Obviously, the higher the degree of supersaturation, the greater the rate of growth. But when the rate becomes too great, large quantities of free, minute crystals are deposited in the solution. These settle on the caps and act as new centers of growth, causing distortion of the crystal to a point where it is no longer usable. On the other hand, diminishing the rate of growth results in a smooth even growth of clear perfect crystals. In general, the method requires close control of temperature of both the growing solution and its atmosphere.

The rocking tank method developed by the Brush Development Co., and employed by Western Electric Co., used a control which maintained the temperature within $\pm 0.1^\circ$ C. These tanks were constructed of stainless steel, measured 48 inches long, 12 inches deep, and 25 inches wide. The seeds were mounted on pins and arranged in rows of eight crystals, each tank containing five rows. The crystals grew to a length of 10 or 12 inches, but as they increased in size, they hindered proper circulation of solution and caused uneven growth and clouding of the crystals. However, since most of the crystals were not affected, they were permitted to reach maximum size before removal.

In the Western Electric plant, these tanks are mounted on four platforms suspended one above the other. On each platform are suspended two rows of tanks, each row containing seven tanks. Of the possible 2,240 crystals from the fifty-six tanks, 80 yields of usable crystals have been attained. The tanks are kept rocking at an even rate to keep the solution circulating around the crystals until the crystals reach the desired length. This method produced several thousands of crystals for the war effort.

Subsequent work with other crystals indicated that this method, although efficient for ADP crystals, was unsatisfactory for crystals then in the laboratory stage, and for these, new methods had to be devised.

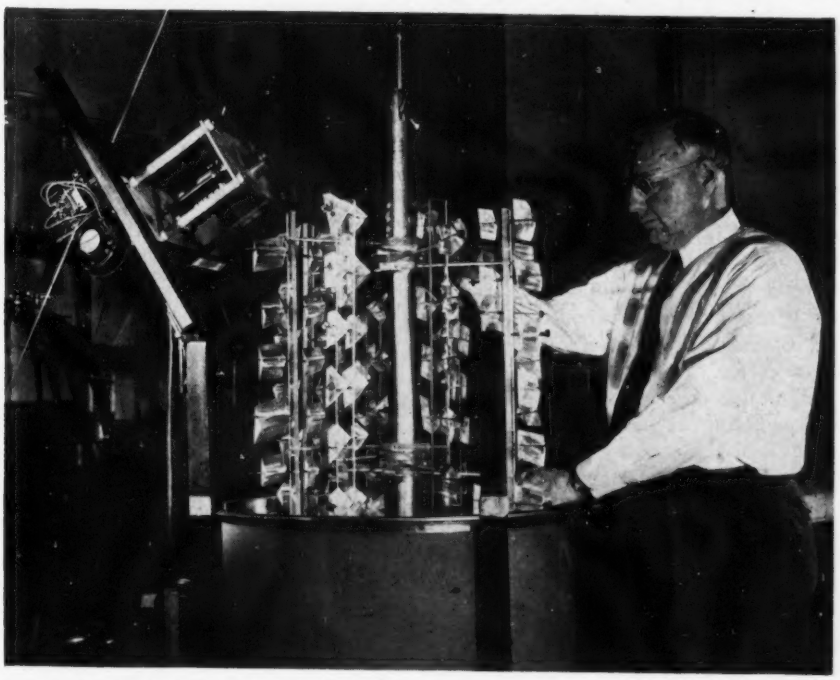


Fig. 4—A. C. Walker of the Bell Laboratories halts motor, and raises the stainless steel tube to check the results of a run in the rotary reciprocating crystal growing tank.

A BETTER METHOD

A new aparatus, developed by A. N. Holden of the Bell Laboratories, was tried on a pilot plant scale and found to be suitable for growing these new crystals. This method is known as the "Reciprocating Rotary Crystallizer Method (Fig. 4.) A stainless steel tube 1½ inches in diameter rotates in a tank also constructed of stainless steel. Stainless steel rods are attached to the tube; at their ends are methacrylate resin frames for holding the seed as it grows. Formerly the crystals had been suspended on the rods through the plastic tubes inserted in the holes (as previously mentioned) to allow easy removal of the grown crystal. The central stainless steel tube on which the entire apparatus is sus-

pended is hung from the cover and is motor driven so that it rotates alternately in opposite directions. This alternation insures uniform rate of circulation of solution around the crystals. The bottom of the tank is heated and the temperature is again controlled to ±0.1° C. Provision is also made for lowering the temperature of the solution. Atmospheric effects can be eliminated by wrapping a felt blanket around the tank. In hot weather the solution is placed in a room at a temperature somewhat below the growing temperature of the crystals, 18-20° C. The temperature of this room is then controlled within 1 - 2° C.

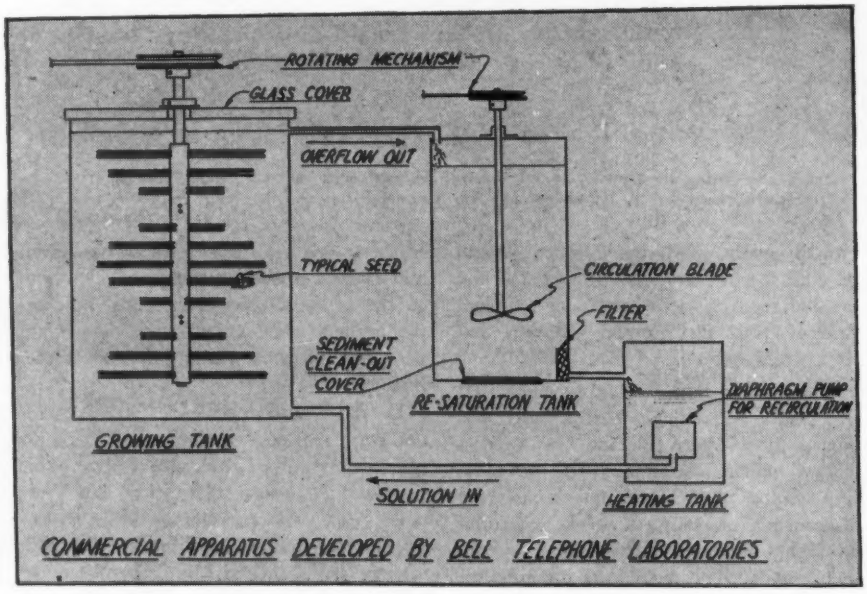


Fig. 5—A continuous supply of saturated solution at the proper temperature keeps the salt concentration in the growing tank solution constant as crystals grow.

This apparatus is less efficient spacewise than the rocking tank but it provides many advantages. Perhaps most important, the rate of growth is greater. Also the solution is somewhat warmer on the bottom of the tank next to the heaters so that any seeds which form in the solution and fall to the bottom are removed by solution, and the material is thus recirculated. Water condensing on the lid of the tank drops back into it and dissolves any floating seeds.

NECESSARY REFINEMENTS

Despite these advantages, this method has its difficulties. The solution in the tank contains a fixed quantity of dissolved salt and must therefore be replaced as the solution becomes dilute (but still saturated). To overcome this defect, Bell Laboratories devise a continuous method of supplying fresh solution (Fig. 5). A growing tank essentially the same as the one just described has two more tanks connected in series with it. In one of them, fresh salt is added to the overflow from the growing tank, after the overflow has been heated to the original saturation temperature. In this way the amount of dissolved salt in the solution remains virtually constant.

Impurities in the form of solid materials however, find their way into this tank. Since these cause imperfect growth, they must be removed. This requires a filter between this tank and the tank in which the solution is raised to one or two degrees above saturation temperature. The latter supplies the growing tank with fresh solution, and the introduction of the fresh fluid causes the overflow into the resaturation tank. Superheating as before, prevents crystallization of solid by cooling of the solution in transit. With this method the number of individual operations is considerably diminished and the crystals are practically 100% usable. Nevertheless, it takes about three months to grow an ERT crystal 6 inches long, 2 by 3 inches in cross section. Production of the Western Electric plant comprising units of 6 cells and pilot units is 30,000-40,000 crystals a year. At the completion of this stage, the crystals are passed on to the cutting departments.

In the cutting department, the wet string saw again comes into play. It cuts the crystal into plates whose dimensions are determined by its electrical frequency requirements.

While the development of this method for producing crystals of EDT (principally) enables industry to be somewhat independent of the natural supply of piezo crystals, work on growing artificial quartz crystals continues.

QUARTZ CRYSTALS

The first appreciable success in growing quartz crystals appears to have been attained by Nacken[3] in Germany. His work began in late 1943 for the same reason as ours—the enormous requirements of quartz oscillator plates for military radio communication. A pilot plant was in operation at the end of the war but had not resulted in a usable commercial process.

A number of projects for growing quartz crystals are now being sponsored by the U. S. Signal Corps. One of the contracts is with the Brush Development Co.[3] They have attained fair success by heating the bottom of a vertical tubular autoclave containing a dilute alkaline solution, a quantity of crystalline silica, and one or more seeds cut from untwinned quartz crystals. The feeder crystals are suspended at the top. High pressure must be maintained at all times. Crystals weighing as much as 6.9 grams have been obtained in a twenty-day period.

The problems encountered in the production of quartz crystals were of the same types as those met in the production of the crystals described above. The formation of seeds in the body of the solution prevented proper growth of the crystal. It was found that the addition of gelatin or sodium oleate to the growing solution largely prevented the formation of these undesirable seeds.

Another problem which was solved was the presence of two types of quartz crystals, twinned and untwinned. It was found that seeds cut from untwinned crystals produced only the desired type of quartz, the untwinned. Hence, only the untwinned crystals were used for the production of seeds.

Many of the present disadvantages in producing oscillator-plate blanks from crystals may be eliminated by this selective production of untwinned crystals. In mining quartz, the prevalence of flaws and inclusions reduces the output of Grade I crystals to a small percentage of the total yield. Moreover, since twinning—optical, electrical, or both—is common in clear stones, large cutting losses result in producing untwinned crystals for oscillator plates.

One may expect synthetic quartz crystals of predetermined characteristics to be produced by careful selection of untwinned seeds of special size and orientation. Processing these into blanks may result in decreased material losses (about one-fifth those incurred with natural crystals) and comparable savings in time.[4]

ACKNOWLEDGEMENT

A special note of thanks is extended to Dr. A. C. Walker of the Bell Laboratories, New York, N. Y. who provided the author with much of the information for this article.

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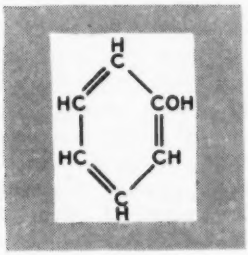
A CI REPORT ON

PHENOL

Part 1: Capacity and Consumption

by R. F. MESSING and W. V. KEARY*



SYNTHETIC PHENOL EXPANSIONS completed or planned since the end of the war will bring the total phenol production capacity of the United States to about 350 million pounds by early 1949. Growing demands by manufacturers of molding, laminating and adhesive resins, 2,4-D and other weed-killers, and fungicides, all major phenol consumers, continue to outstrip production. Further expansion rests on new sources of benzene—probably petroleum.

PHENOL production has quadrupled in the past decade (Fig. 1). Virtually all of this increase may be attributed to synthetic production; recovery of natural phenol by tar distillers has remained at about 20 million pounds per year for several years. Little increase in natural phenol output is anticipated since steel companies will likely continue to find it advantageous to burn a substantial portion of their tar production to supplement energy obtained from other sources. It is noteworthy that recent news releases show a trend towards refining of tars by the steel companies to recover various by-products, perhaps at the expense of sales of tar to outside refiners.

SINCE 1946

The growth in production of synthetic phenol since 1946 has been particularly striking. Production of synthetic phenol in 1948 is expected to reach 280 million pounds. The average output for the years 1943-6 was only slightly greater than 180 million pounds. About 25% of this increase was attained by use of existing capacity inoperative because of raw material shortages. The reminder represents new plant completions. It is estimated that about 48% of the 1947 production of synthetic phenol was via chlorbenzene, 43% by sulfonation of benzene, and 9% by the Raschig process.

* Arthur D. Little, Inc. Cambridge, Mass.

At present, there are six domestic producers of synthetic phenol (Table 1) The capacities shown in the table are estimates obtained through discussion with industry representatives, rather than from official statements by the individual producers. For this reason, the data should not be considered as reflecting exact capacities at the present time.

Two operate the chlorbenzene process, three the benzene sulfonation process, and one the Raschig process. Expansion of the present synthetic phenol capacity of four of these producers is believed to be underway. Dow has recently placed new equipment in operation, and is reported to be planning extensive repairs of older portions of the plant in coming months.[1] Monsanto is removing some bottlenecks in its present phenol plant at Monsanto, Illinois, in connection with a resin expansion in its Springfield, Mass., plant. Completion of this enlargement of phenol facilities is expected in late 1948. Durez is adding a multi-million dollar project at another location to its 25 million pound-per-year plant at North Tonawanda, N. Y. Reichhold has expanded its phenol plant at Tuscaloosa, Ala. as part of a $10,000,000 program for expansion of resin production.

At least two present producers are considering the establishment of new plants for production of phenol on the West Coast, although neither is known to have taken action because of uncertainty of raw materials supplies. Nobell Resins, Inc. of Azusa, Calif. will be the first synthetic phenol producer on the West Coast, using the sulfonation process. Their plant is scheduled to begin operation late this summer.[6] The first announcement called for production of 3,000,000 pounds per year.[5]

The Heyden Chemical Corp. acquired the government phenol unit at Memphis, Tenn. in 1946.[6] As yet, phenol has not been produced, but it is operating for the production of monochlorobenzene.

Solvay Process Co. has manufactured phenol by the benzene oxidation process at Syracuse, N. Y., but the unit has since been shut down.

It has been estimated that total phenol capacity will reach 350-400 million pounds by early 1949.[7] This represents some 330-380 million pounds of synthetic phenol capacity.

Virtually all of the manufacturers of synthetic phenol are well integrated through manufacture of some phenol derivatives, e.g., phenolic resins, salicylates, chlorinated phenols, etc. Despite this tendency towards production of end derivatives by the phenol manufacturers, it is reported by the U.S. Tariff Commission (Table 2) that producers of synthetic phenol sold 87% of their total output in 1946, using the remaining 13% in their own operations.

USES

Phenol allocation by end uses for 1944

and the estimated distribution for 1947 are shown in Table 3. Phenolic resins are the predominant consumers; in 1947, it is estimated that 161 million pounds of phenol, 60% of the total consumption, were utilized in resin production.

RESINS

The importance of tar-acid resins during World War II is a matter of record. Tar-acid resins consist principally of unmodified phenol-formaldehyde polymers, but include some modified resins, containing cresol, xylenol, alkylated phenols and resins (Fig. 2).

Since adequate end-use data for mixed phenolic resins are unavailable, the discussion of resin applications is limited to unmodified resins, which account for the bulk of the phenol consumption. As an average figure, one pound of phenol yields about 1.1 pounds of resin.

The relative importance of the various outlets for phenol-formaldehyde resins can be seen in Figure 3. Molding, the most important use, made up an estimated 53% of total phenol-formaldehyde resin consumption in 1947. Phenolic moldings have good physical properties, and by virtue of low cost give evidence of continued growth, although possibly at a slower rate because of the advent of a greater number of competitive materials. Phenolic moldings are used in large volume in industrial-type applications, e.g. in electrical equipment, bonding of abrasives, brake linings, instrument cases, and pump impellers. However, for light colors in the end product, urea and melamine resins will probably continue to be preferred in the thermosetting field. Price consideration should continue to favor the phenolics.

In 1947, laminates consumed about 15% of the total volume of phenol-formaldehyde resins. Laminates made of resin-bonded wood, cloth, or paper are used in radio housings, refrigerator liners, gears, and other applications where good resistance to abrasion and impact is demanded. An outlet for phenolic laminates showing special promise is the field of plywood cladding. By applying a paper impregnated with a phenolic resin to the outside of a plywood sheet, a hard, moisture resistant, and scuff-proof overlay is obtained. Much of this product is used in table tops, packing boxes, and decorative panels. At present, the consumption of phenolic resins in plywood cladding is estimated at 1,300,000 pounds annually.[8] It has been predicted that the plywood overlay market will require 30 million pounds of resin per year by 1952.[8] A more optimistic estimate indicates that the 27-39 million pound-per-year level might be reached as early as 1950.[10] It is interesting to note that a substantially larger requirement for phenolic resins is indicated for overlays than the total now used as an adhesive in bonding exterior-grade plywood.

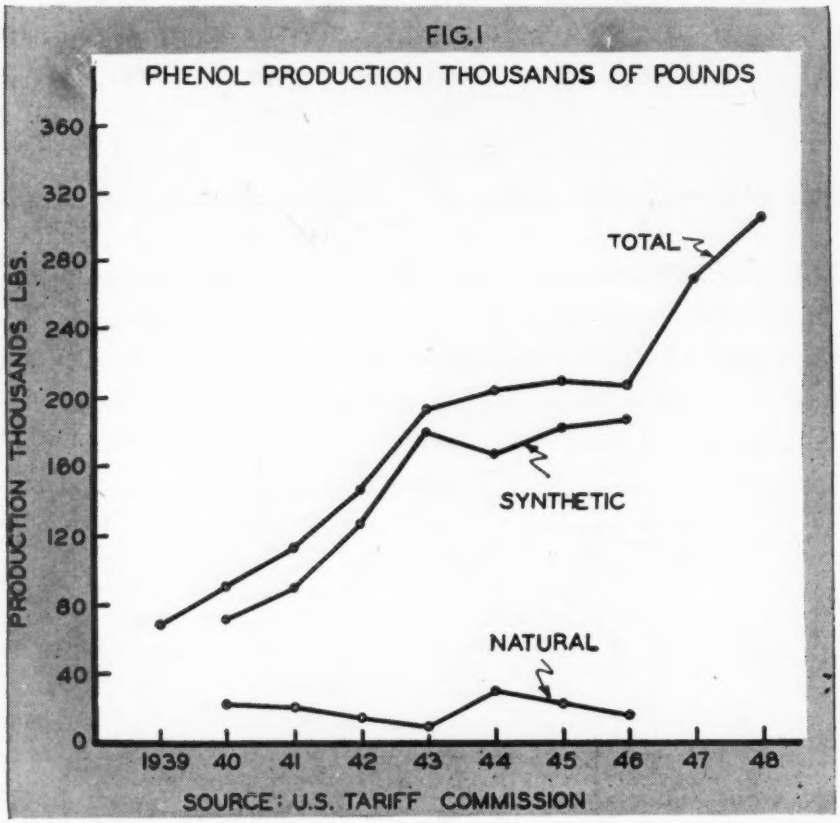
Adhesives are rapidly becoming one of the more important outlets for phenolic resins. Of special interest is the use of phenolics for bonding exterior grades of plywood where moisture resistance is essential. Ordinary or so-called "Moisture resistant" plywood, on the other hand, is bonded with soybean, casein, urea, or other glues which are relatively more sensitive to water than the phenolics. A comparison of the quantities of all adhesives used in bonding softwood plywood with phenolic adhesives is shown at the bottom of the page.

Since 1939, softwood plywood output has nearly doubled (Fig. 4), although production dropped during 1943-45 because of shortages of labor and suitable woods. Exterior-grade plywood displayed steady growth during this period, however, and shows excellent prospects for further expansion. Use of phenolic resins in plywood is being stimulated by development of means of extending the phenolics to make them more nearly competitive in price with other glues. Demand for phenolic glues is said to exceed the supply by at least 75%.[12] Companies active in expansion of phenolic resin facilities to serve the plywood industry in the Pacific Northwest include American-Marietta, I. F. Laucks Inc. (Monsanto Chemical Co.), the Chemical Division of the Borden Co. and Reichhold Chemicals.

Additional but smaller quantities of phenolics are used in bonding of hardwood plywood for cabinets, radios, interior trim, store fixtures, boats, boxes, and the like. Approximate consumption of phenolic resin (dry basis) for bonding hardwood was 2.3 million pounds annually in the 1943-45 period[11]. Later figures are not presently available.

Use of phenolics in protective coatings during the years 1941-46 declined substantially as contrasted with increased consumption for other uses. While phenolics will undoubtedly benefit from generally increased activity in the protective finishes industry, other resins, especially alkyds, which have superior color retention, drying properties, and

FIG. 1



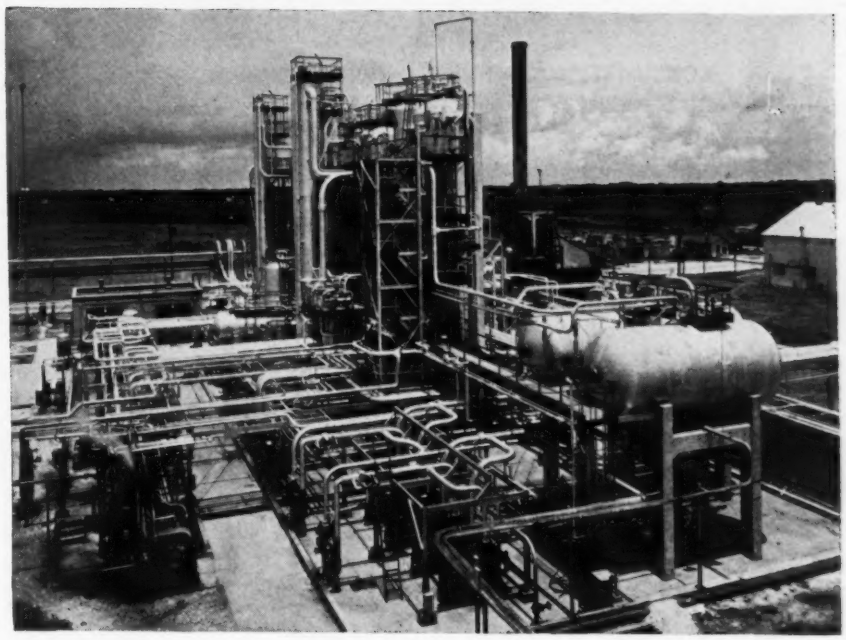
Softwood Plywood Adhesives

Year	Total Adhesives Used (Dry Basis) Millions of lb.	Phenolic Resin Used (Dry Basis) Millions of lb., % of total		Phenol Equivalent Millions of lb.
1942	51.2	6.8	13	6.2
1943	41.3	7.9	19	7.2
1944	42.3	9.3	22	8.5
1945	35.8	7.8	22	7.1
1946	36.0	9.4	26	8.6
1947	47.0	13.4	29	12.2

Source: Bureau of Census.
Note: Values assume a 40% solids content in phenolic glues.

durability appear to be favored. On the other hand, phenolics are indicated where a hard finish resistant to water and alkalies is required.

"Chemical Manufacture" is second in importance among the various outlets for phenol, accounting for 11% of total consumption in 1947. Of the several chemicals included in this category, two —weed killers and substituted phenols— are of special importance.



Courtesy Standard Oil Co. (N.J.)

The petroleum industry consumed about 7,500 tons of phenol in 1947.

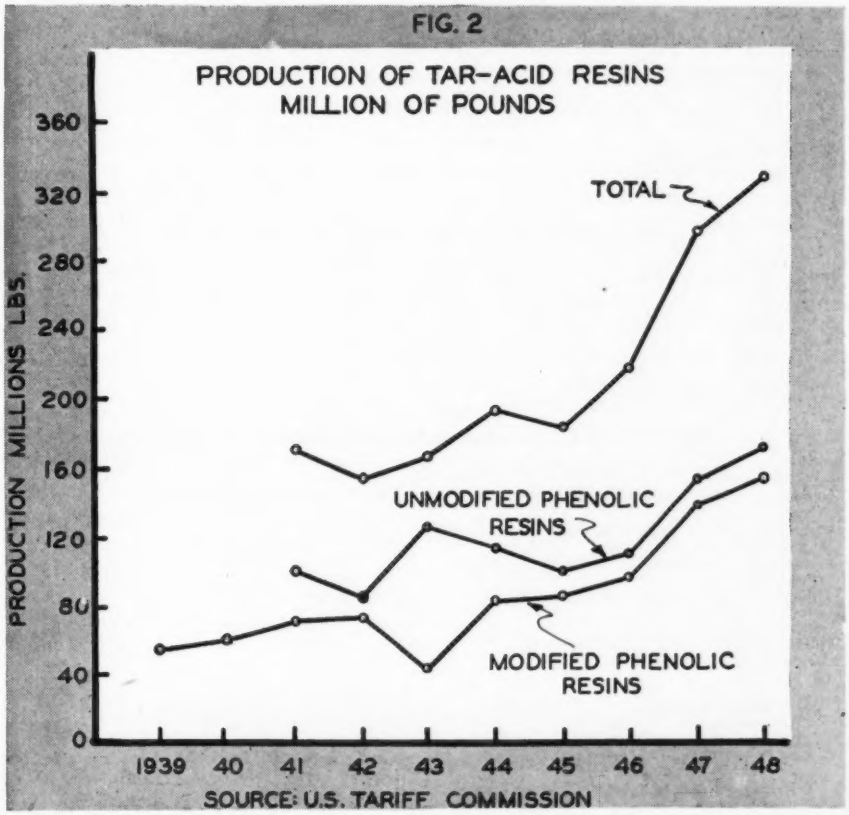
AGRICULTURAL CHEMICALS

The public recognition of the value of selective weed killers has been evident in the rapid growth in requirements for 2.4-dichlorophenoxyacetic acid (2,4-D) and its derivatives. In 1946, about 6 million pounds of 2,4-D and its derivatives (salt and ester forms) were produced in the United States.[13] The 1948 production is expected to reach 18 million pounds,[14] enough to treat 10-20 million acres of agricultural crops.[15] Part of the output will also be used to treat grass in lawns, golf courses, and other areas to minimize weed growth.

Phenol requirements for 2,4-D manufacture for the years 1946 and 1948, assuming a 95% product yield, are 2.8 million pounds and 8.1 million pounds. Estimates made by various land-grant colleges of increased crop yields obtained by application of 2,4-D demonstrate a large potential market; it is visualized that the yearly requirement for herbicides of the 2,4-D type will reach 100 million pounds annually within the next several years.[3] The corresponding phenol requirement is 45 million pounds. Among the principal present producers of 2,4-D and its derivatives are Dow Chemical Co., E. I. du Pont de Nemours & Co., Inc.; Monsanto Chemical Co., Michigan Chemical Co., Pennsylvania Salt Mfg. Co., J. T. Baker Chemical Co., Pittsburgh Coke & Chemical Co., Sherwin-Williams Co., American Chemical Paint Co., and Kolker Chemical Co.

Other phenol derivatives also find use in the weed-killer field. Dinitrophenol serves as a selective weed killer (as well as an insecticide), not through overstimulation of growth (as with 2,4-D,), but by limited absorption through the exposed leaf surfaces of certain species of plants. Dinitro o-sec. butyl phenol and the similar amyl derivative act as contact herbicides, killing all types of plants without regard to species.

FIG. 2



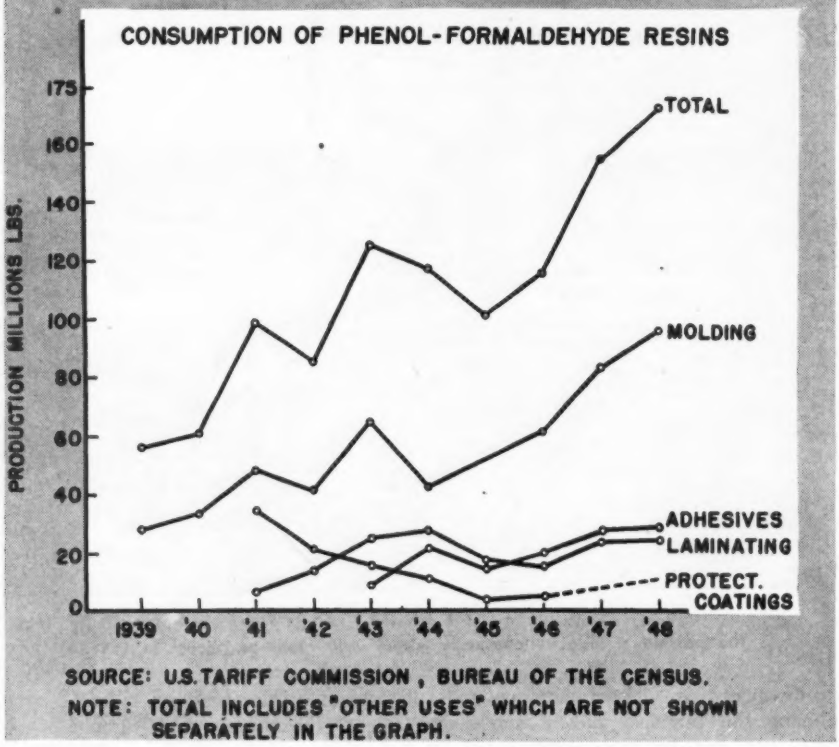
ALKYL PHENOLS

Increasing attention is being given to alkylated phenols as intermediates for resins used in protective finishes. Addition of a hydrocarbon group to the phenol structure in the para position minimizes the after-yellowing and improves the oil solubility of the corresponding resin. Even though long hydrocarbon chains are preferred from the standpoint of color, their slow-drying properties place a practical limitation on the chain length of 4 to 5 carbon atoms. Dow Chemical Co., Gulf Oil Corp., Rohm & Haas Co., Koppers Co., Reichhold Chemicals, Inc., Sharples Chemicals Corp., and Carbide & Carbon Chemicals Corp. have been associated with development of the alkylated phenols such as p-tert, butyl phenol, p-tert. amyl phenol, p-cresol, and others.

Additional derivatives of phenol included in the category "Chemical Manufacture" are aminophenols, amino nitrophenols, amino chlorophenols, bromophenol, chlorphenols (except pentachlorophenol reported under "Insectcides, etc."), alkyl aminophenols, phenol sulfonic acids and resorcinol. These compounds are used as dye intermediates, in resins, and in several other organic syntheses.

Phenol serves as the basic raw mate-

FIG. 3



rial for salicylic acid, which is produced by reaction of sodium phenate and carbon dioxide. The United States production of salicylic acid has averaged some 4.8 million pounds annually for the past decade, having shown practically no increase over the 10 year period. Based on a product yield of 90% (probably high), the corresponding requirement for phenol is 3.9 million pounds annually. Salicylic acid is used as dyestuff intermediate, and in the manufacture of other salicylates, e.g. methyl salicylate (synthetic oil of wintergreen), which is a flavoring for confectionery and food products; dentifrices; and toilet preparations. Acetyl salicylic acid (aspirin), sodium salicylate and methyl salicylate are important medicinals.

Phenol serves as an important selective solvent for refining lubricating oils. The approximate refined oil capacity using the phenol solvent extraction process in 1946 was 25,000 bbl. per day, as compared with total refined oil capacity of 89,500 bbl. per day;[4] the other solvents used include furfural, propane and a mixture of cresylic acid and phenol (Duo-Sol process), dichlorethyl ether (Chlorex), nitrobenzene, and sulfur dioxide. These materials remove asphaltic, aromatic, and unsaturated compounds, thereby improving the viscosity index and oxidation resistance of the oil. Losses of phenol in the extraction process are reported as only 0.01% of the total solvent circulated per day.[5] Three new plants using the phenol process are under construction, despite the tendency of most refiners to use other processes utilizing more readily available solvents.

Several phenol derivatives are used in the manufacture of insecticides, disinfectants, fungicides, and germicides. Pentachlorophenol has shown especially rapid growth in recent years. Its principal use has been as a wood preservative, to minimize damage from rot and termite attack. In 1945, production of pentachlorophenol was only about 280,000 pounds, but it increased to 15 million pounds in 1946 and 20 million pounds in 1947, largely as a result of greatly expanded production by Dow Chemical Co. The corresponding requirements for phenol (again assuming a 95% product yield) are 0.1, 5.6 and 7.4 million pounds. While creosote oil continues to be the largest-volume wood preservative, pentachlorophenol is used not only in heavy-construction applications where creosote oil is conventionally applied, but also in the general construction field where a non-toxic preservative for painted lumber is desirable. In some cases, adequate protection is obtained by dipping or spraying wood with pentachlorophenol, rather than by the more costly pressure treatment. The material is made by Dow Chemical Co. and Monsanto Chemical Co.

Other phenol compounds used in the germicide field include tetrachlorphenol and benzylphenol, the latter also serving as a preservative for industrial products.

Triphenyl phosphate has been produced in substantial quantity for use as a plasticizer for cellulose acetate film, particularly motion picture film. Its outstanding characteristic is that of conferring relative non-inflammability upon resins into which it is incorporated. Since the material is toxic, however, it is not used in articles which come into contact with foods. Other phenol derivatives employed as plasticizers include cresol diphenyl phosphate and mono o-xenyl diphenyl phosphate, which may be used

Table 1—Synthetic Phenol Productive Capacity

Company	*Plant Location*	*Process*	*Estimated Capacity Thousands of lbs./year*
Dow Chemical Co.	Midland, Mich.	Chlorbenzene	120,000
Monsanto Chemical Co.	St. Louis, Mo.	Benzenesulfonate	85,000
Durez Plastics & Chemicals, Inc.	No. Tonawanda, N. Y	Raschig	25,000
Reichhold Chemicals, Inc.	Tuscaloosa, Ala.	Benzenesulfonate	33,000
General Electric Co.	Pittsfield, Mass	Chlorbenzene	15,000
Barrett Division, Allied Chemical & Dye Corp.	Frankford, Pa.	Benzenesulfonate	12,000
			282,000

Table 2—Sales of Synthetic Phenol by Manufacturers

Year	*Thousands of pounds*	*% of Production*
1941	61,269	66
1942	101,901	80
1943	163,166	90
1944	148,805	86
1945	142,472	79
1946	159,537	87

Source: U. S. Tariff Commission.

Table 3—Phenol Consumption Pattern (Thousands of pounds)

		1944[1]	1947[2]
Phenolic resins		106,655	161,000
Chemical manufacture (incl. substituted phenols)		11,806	30,000
Salicylates		11,264	10,000
Petroleum refining (incl. phenol used in oil additives and oil refining materials)		10,857	15,000
Disinfectants and insecticides (incl. chlorinated phenols)		5,707	15,000
Triphenyl phosphate and other plasticizers		4,585	5,000
Toluene extraction		4,262	2,000
Dyes and inks		2,187	2,000
Medicinals, other than salicylates		1,733	2,000
Misc. uses and small orders		2,121	5,900
	Subtotal	161,177	247,900
Direct military		20,702	.....
Foreign		23,307	20,600
	Grand total	205,186	286,500

[1] *WPB Allocations reported by Bureau of the Census.*
[2] *Estimated.*

with polyvinyl chloride and other vinyl resins.

As shown in Table 4, shipments of phenol abroad became an important factor during World War II, principally as a result of large shipments to the USSR under the Lend-Lease program. In 1944, exports of phenol to Russia reached 91% of total exports of 28.7 million pounds. During 1946 and 1947, however, the export pattern changed in favor of the United Kingdom, Canada, and the Western European nations. As the coal-tar industries of Western Europe regain their pre-war stature, requirements for phenol from the United States will again decline to the 1939-41 level.

Table 4—Phenol Exports

Year	Thousands of pounds
1939	2,058
1940	4,304
1941	3,186
1942	19,109
1943	30,839
1944	28,727
1945	16,852
1946	24,868
1947	20,557

Source: Bureau of Foreign & Domestic Commerce, U.S. Department of Commerce.

The foregoing illustrates the difficulties encountered in projecting a demand estimate for phenol based upon changing requirements of the various outlets. In general, however, it appears that strong growth trends are evident in several products, especially phenolic resins, weed-killers, and fungicides. Continued expansion of phenol productive facilities and raw materials supplies will be required to meet this rapidly increasing demand.

Phenol prices have varied from 9.5 to 12.0 cents per pound over the last ten years. However the preceding fifteen years produced a decrease from 30¢/lb in 1924 to 12¢/lb in 1939. Technical advances and larger scale production were principal factors in this almost precipitous price decline.

Table 5—Synthetic Phenol Prices

Year	Quoted price, USP, tanks ¢/lb.	Average Sales Value* ¢/lb.
1939	12.0	10.0
1940	12.0	...
1941	11.0	10.0
1942	11.5	11.0
1943	9.5	9.0
1944	9.5	10.0
1945	9.5	9.0
1946	10.25	9.0
1947	10.25	...
1948	11.8	...

* *U. S. Tariff Commission*

THE FUTURE

Further expansion in phenol production appears to hinge largely upon development of additional sources of benzene. While it is outside the scope of this paper to review the benzene supply situation in detail, it is interesting to note that manufacture of synthetic phenol required use of some 30 million gallons of refined benezene in 1947, or 18% of the total production. Production of benzene is listed in Table 6.

While supplies of benzene now closely approach requirements, expansions in consuming industries such as styrene, detergents, dichlorobenzene, and phenol are placing increasing demands on the relatively inflexible supply obtained from coal coking. Production of benzene from petroleum by hydro-forming or cracking is regarded as the most likely avenue of relief from the anticipated shortage. Benzene from coal is now quoted at 21¢/ gal. Opinions differ as to the probable range of price necessary to justify production of benzene from petroleum, with estimates ranging from 23¢/gal.[15], to as high as 30¢ or 32¢ per gal. As the price of benzene trends upward, increasing substitution of toluene for benzene may help to stabilize the benzene price near that of toluene, which is presently 28¢/gal. In any event, an increase in the price of benzene will likely be reflected in a higher cost of production and sales price for phenol.

FIG. 4

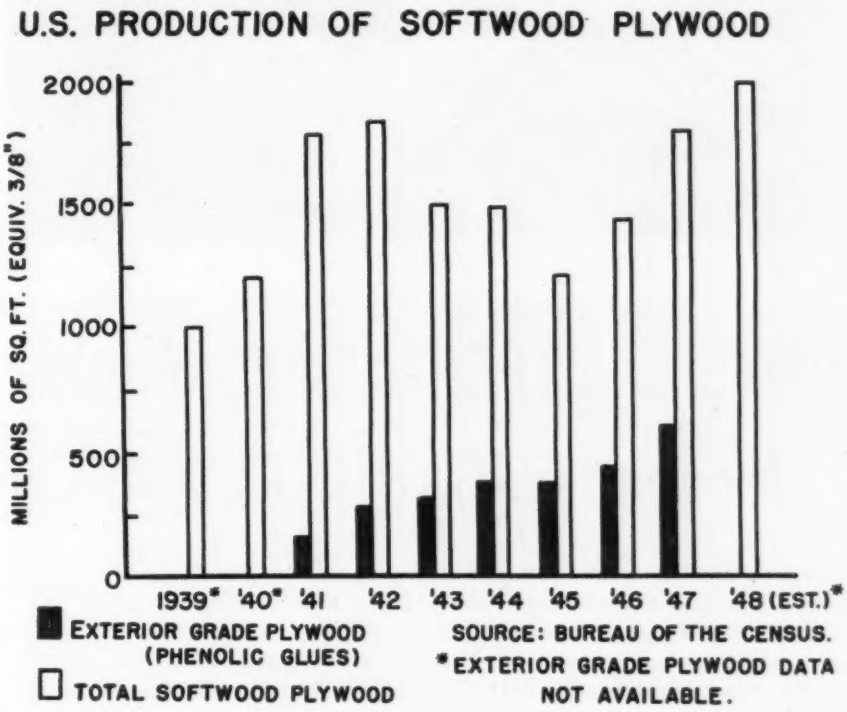


Table 6—Benzene Production (Thousands of Gallons)

Year	motor benzene[1] Benzene, except	Motor Benzene	Total
1939	30,470	86,246	116,716
1940	36,556	101,140	137,696
1941	44,812	112,508	157,320
1942	85,257[2]	68,662	153,919
1943	142,047	24,390	166,437
1944	178,392	18,557[3]	196,949
1945	156,215[2]	32,451	188,866
1946	135,240[2]	31,827	167,067
1947	166,091[2]	15,908[3]	181,999
1948[4]	163,000[2]	12,400[3]	175,400

Source: U. S. Tariff Commission.
[1] *Does not include benzene produced from petroleum, except where noted.*
[2] *Includes benzene produced from petroleum.*
[3] *Production of coke-oven operators only. Does not include production of tar distillers.*
[4] *Estimate based on Jan.-Feb. production.*

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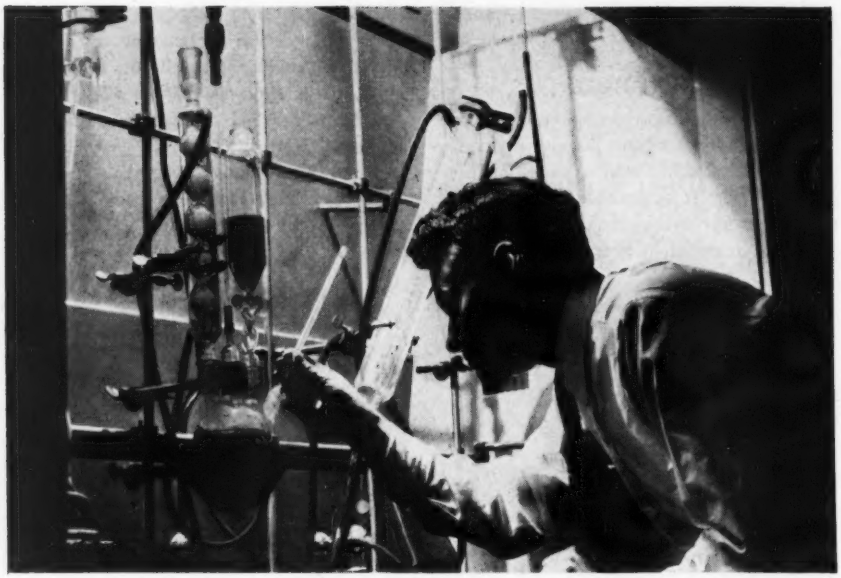


PHYSICAL TECHNIQUES Further Modern ORGANIC RESEARCH

EDITORIAL STAFF REPORT

THE TECHNIQUES OF PHYSICAL CHEMISTRY, utilizing precise measurements to study the character of organic reactions, are extending fundamental knowledge, improving processes.

FIFTY years ago, organic research consisted of mixing reagents together under a variety of experimental conditions, hoping for something to happen. Something usually did, for chemistry—as we know it today—was an unharvested tree; and all one had to do was to shake it and pick up the fruit.

The "shotgun" technique—to use a different metaphor—is still useful today, but it is not enough. The "what" target is a large one the "how" and "why" targets are smaller, but a bull's-eye is more rewarding in that it probes more closely to the fundamental nature of the molecules and their inter-actions. It has been necessary to take more careful aim at the smaller targets, and the precise techniques of physical chemistry are being invoked more and more to steady the aim.

RECENT TYPICAL STUDIES

One of the acknowledged marksmen in the field is L. P. Hammett, of Columbia University. In a recent interview he listed some of the current studies which characterize the modern approach to organic chemical problems.

Among these are the wartime studies by Westheimer and Kharasch[1], in this country, and Bennett, Brand, and Williams[2], in England, on nitration of aromatic compounds. These researches were government-sponsored—of obvious pertinence to the manufacture of explosives.

Bennett *et al.* reviewed the evidence pointing to the existence, in mixed nitrating acid, of the ionic species NO_2^+. The ultraviolet absorption, for example, was different from that of free nitric acid or of nitrate ion. The vapor pressure of the solution is lower than would be expected in the presence of nitric acid or nitrogen pentoxide. Electrical conductivity of the solution is high, although no nitrate ion is present. Salts,

$(H_2NO_3)^+(ClO_4)^-$ and $(H_3NO_3)^{++}(ClO_4)_2^-$

were obtained, and cryoscopic studies checked the number of ions in each salt. Furthermore, during electrolysis of the salts in nitromethane, nitric acid migrated to the cathode.

These investigators were able to electroylze mixed acid itself, showing that nitrogen migrated cathode-ward, and they further measured the ion mobility as compared with barium.

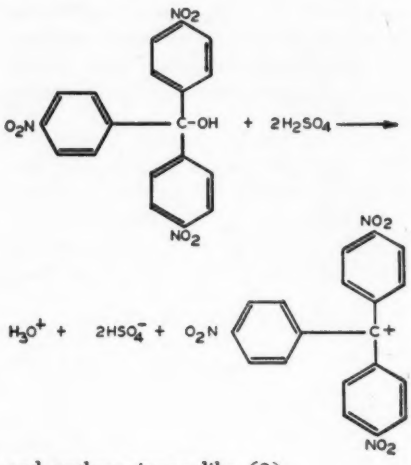
Westheimer and Kharasch commented on the fallacious notion that the function of the sulfuric acid is to take up the water. Acid of 90 per cent strength (the optimum) is a thousandfold faster than 80 per cent acid, and 95 per cent acid is threefold better than 100 per cent acid. Furthermore, phosphorus pentoxide, which takes up water avidly, doesn't affect the nitration rate of 95 per cent acid when added to it.

The investigators concluded that ionization of the solution is the key and that the NO_2^+ ion is the effective nitrating agent. The ionization could be

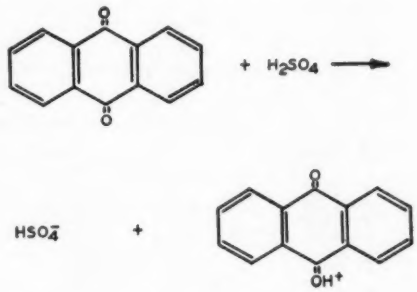
(1) $HNO_3 + 2H_2SO_4 \rightarrow H_3O^+ + NO_2^+ + 2HSO_4^-$, or

(2) $HNO_3 + H_2SO_4 \rightarrow H_2NO_3^+ + HSO_4^-$.

In order to test these hypotheses, the researchers looked about for indicators which ionized in the above two ways. The indicator whose ionization is analogous to the ionization of mixed acid should give an ionization-vs.-acid-strength curve parallel to the nitration-activity-vs.-acid-strength curve for the mixed acid. Tris-(*p*-nitrophenyl)-carbinol was found to ionize like (1):



and anthraquinone like (2):



Ionization of the former is so parallel to nitration acitivity that hypothesis (1) is strongly indicated:

Now that the elusive NO_2^+ ion has been caught and taged, the "by guess and

by gosh" of industrial nitration has been supplanted by a sounder foundation of knowledge.

BUTANE ISOMERIZATION

What makes *n*-butane isomerize? That question bothered Universal Oil Products Co.'s Herman Pines and R. C. Wackher.[3] They suspected that the "impurities" in ordinary, commercial butane – olefins, water, and air – individually or collectively promote the reaction.

Sure enough, they found that pure *n*-butane doesn't isomerize, but as little as 0.01 per cent of *n*-butane was enough to get the rearrangement under way. In experiments using an aluminum bromide-hydrogen bromide catalyst, they recorded the following data:

Mol % Butane:	0.0	0.03	0.08	0.58
% isobutane produced:	0.2	2.1	19.3	65.6

High temperature or free acid also gave positive reactions, simply because olefins are formed under those conditions.

In similar experiments where aluminum bromide-deuterium bromide was the catalyst, it was found that when exchange of deuterium with the hydrocarbon was high, isomerization was also high:

Feed	*% Isomerization*	*% Deuterium Exchange*
n-Butane	0	6
n-Butane plus 0.1 mol % *n*-butene	40	92

But if the catalyst is deuterium bromide-free deuteroxyaluminum bromide (DOAl Br_2), isomerization is independent of deuterium exchange:

Time (hrs.)	*% Isomerization*	*% Deuterium Exchange*
20	3.7	4.3
42	21.	5.4

It is obviously the bromide ion, and not the deuterium (or hydrogen), that is involved in isomerization. This evidence, together with the facts that oxygen or water also promote isomerization—it can be shown that each could give rise to alkyl halide—can be explained consistently by thetheory that carbonium ions are responsible for a chain-reacting isomerization: Butyl chloride breaks up into butyl+ and Cl—; the former bangs into a passing butane molecule, rearranges, steals a hydrogen atom, and leaves the new bereft butyl to go on its way and repeat the process.

Thus the "impurities" in ordinary isomerizations are necessary components of the reaction mechanism, but only by employing them individually in precise, infinitesimal amounts could their role be ascertained.

PEROXIDE FATE

What happens to the peroxide in peroxide-catalyzed polymerizations? Bartlett and Altschul[4] attacked this problem by using chlorobenzoyl peroxide (rather than the more common benzoyl peroxide, since the chlorine can be followed more easily) to catalyze the polymerization of allyl acetate.

Most (72 per cent) of it, they learned, landed in the end-groups of polymer molecules. The smaller portion was found as free *p*-chlorobenzoic acid. Also, most of that which was bound to the polymer was the chlorobenzoate radical; only a fifth as much occurred as the chlorophenyl radical. Thus of the following reactions, (1) is more common than (2), and the sum of them is greater than (3):

(1) $C_6H_5COO + R^* \rightarrow C_6H_5COOR$

(2) $C_6H_5COO + R^* \rightarrow CO_2 + C_6H_5R$

(3) $C_6H_5COO + R^*R \rightarrow C_6H_5COOH + R{=}R$

Of practical importance in plastics manufacture were the results of further studies which showed that during the course of polymerization, monomer concentration is a linear function of peroxide concentration; and that carbon dioxide evolution is increased in the presence of oxygen.

Having learned what to expect of allyl acetate, the same investigators turned to copolymers of it with maleic anhydride. This copolymerization is remarkably selective, in that the polymer contains the two components in a molar ratio of 1:1, even though the ratio of monomers present is as high as 5:1 (with either one predominating). The copolymerization proceeds faster at 30° C. than the polymerization of either single component at 80° C. And while one molecule of benzoyl peroxide will polymerize 29 maleic anhydride molecules or 36 allyl acetate molecules, it will copolymerize from 187 to 427 molecules.

The evidence points to the fact that a peculiar electronic resonance structure of maleic anhydride is responsible for the selectivity of the polymerization; and that the two types of molecules present tend to behave like charged particles. It is adduced that the same structure that makes maleic anhydride selective in copolymerization, makes quinone inhibitive of polymerization. Maleic anhydride, then, stands almost alone on the narrow ledge between unselectivity and inhibition—and the occurrence will not be found often.

PROBING DEEPER

The above sketchily presented examples show how modern researchers are employing the tools of physical chemistry in an increasingly large degree to get at the very mechanics of molecular interactions. Many more examples could be given—tracing reaction merchanisms via radioisotopes is one—but the principle remains the same: Once a reaction is understood, rather than just observed, it can be put into practice more efficiently. The reaction mechanisms being worked out by these methods will allow more precise calculation of thermodynamic data; more accurate knowledge of the effect, or lack of effect, of impurities; better choice of operating conditions. The truths being revealed today in fundamental research will tomorrow find their way into handbooks of engineering data; and on the basis of those data, day after tomorrow new plants will be built.

The infra-red spectrometer, useful in routine analyses, is also a powerful research tool, yielding information on hydrogen bonding, association, and bond energies.

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Ball-Point Pens and Inks

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W. A. Sheaffer Pen Co., Fort Madison, Iowa

BALL-PEN INKS—though small in volume of production—are a big factor in the $27 million-a-year ball-point pen business where each pen design requires a special ink.

WRITING instruments, in which a ball, housed within the socket of a tip, transfers writing fluid from a reservoir onto a writing surface, are the product of years of intermittent development. Both United States and foreign patents date back over fifty years, and commercial constructions appeared here as early as 1895.

The recent sensational development of the ball-point pen market is familiar to almost everyone, as are some of the popular and technical aspects[1,2,3]. However, the early history prior to the Biro pen has not been published.

Early U. S. ball-point pens were based on features patented by G. A. Werner[4] and A. W. Askew.[5] Ink for Askew's marking device was formulated of lampblack and castor oil. Werner's grooved annular bearing for metering ink flow made practical a ball small enough for writing. This construction was sold commercially by a company formed by these two men.

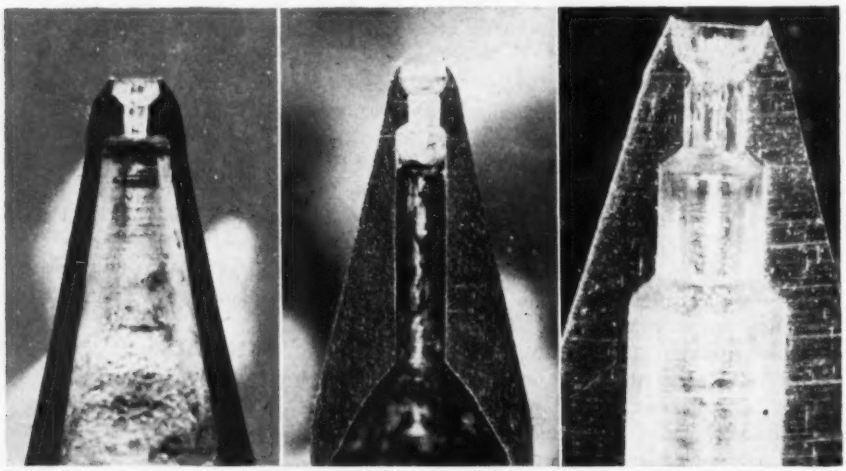
A French patent issued in 1936 describes an early ball pen said to have been successfully produced in Europe. Another French patent[7] issued in 1939 to L. J. Biro discloses a structure similar to this: manually adjustable pressure means for supplying a viscous ink to a ball that rotates on a writing surface. Biro, now a resident of Argentina and associates produce ball-point pens and grant licenses under their many U. S. and foreign patents.

Early in the year 1944, a ball-point writing instrument called the "Eterpen," manufactured and sold in Argentina, was received by the Office of the Quartermaster General from an Army Air Corps officer with a request for a project to develop or obtain such a pen in this country*[8]. The features of interest to the Air Corps were: this pen did not leak in high altitudes; the ink wah unaffected by climatic changes, and was quick drying; and sufficient ink was available in the reservoir to last a considerable length of time.

Because of the war, the State Department requested that no negotiations be entered into with Argentina, and it was determined, therefore to contact American manufacturers for production here. Specifications were set up and prints of a drawing were submitted to Eversharp, Inc., the W. A. Sheaffer Pen Co. and Eberhardt Faber Co. Contracts were also made with the Graflex Co., Gem Safety Razor Co. and the Parker Pen Co.

BALL-POINT PENS

Essentially, the writing unit of all ball-pens consists of a metal tip having at the point a socket which contains a ball. The lip of the socket is constricted so that the ball cannot fall out, yet can rotate freely when in contact with the writing surface. The inner construction of the socket is such that the ball is constantly bathed in ink. While writing there is a considerable thrust-pressure upon the ball. To withstand this pressure the ball is provided with a firm, unyielding seat. Other features of design are usually incorporated to "meter" or limit the amount of ink carried to the writing surface as the ball rotates. Various manufacturers have solved these problems in different ways as pictured.



Various tip designs supply ink to ball (l. to r.): Biro, with radial channels from tube to annular channel; no channel, but large tube; annular channel fed by grooves.

The balls used are steel bearing balls which are quite hard and highly accurate as to sphericity. Most manufacturers use a ball one millimeter in diameter, although a few special-purpose ball-pens have been made using larger balls.

The ink reservoirs of ball-pens are of two types. Some have a flexible synthetic resin sack. In others the reservoir is a metal or plastic tube, one end of which is attached to the writing tip and the other end is open. Currently the ink capacity of ball-pen reservoirs ranges from 0.5 to 1.4 ml.

The minimum writing angle possible with a given pen depends upon the thickness of the lip and upon the extent to which the ball protrudes from the lip. For a practical minimum writing angle, the lip cannot extend more than a few thousandths of an inch past the equator of the ball. This limitation, together with the small size of the unit, and the very small clearances required between the ball and socket (¼ to 1 micron), emphasizes the extremely close tolerances necessary for a satisfactory writing tip. These tolerances approach very closely the limits possible by present-day mass production methods under conditions of close temperature control of machines and of rigid quality control inspection. Even under the best conditions, the quality-minded manufacturer has relatively heavy scrap losses from rejects of tips. The differences in costs between ball-pen writing units now on the market usually reflect the manufacturers' care in inspection and elimination of defective tips.

Since the tip is inclined to be short-lived because of its susceptibility to wear, corrosion or damage, pens with so-called permanent tips have not been very successful, and most manufacturers have adopted a design which incorporates a new writing tip in each refill unit. For the same reasons, pens having excessively large ink capacity have been unpopular.

BALL-PEN INKS

Satisfactory ball-pen inks are highly

* Statements on the interest of the Quartermaster General in ball-point pen production are based on reference 8.

specialized materials. They are viscous liquids consisting of a vehicle of oil or other organic liquid in which is dispersed coloring material. The latter may consist of dyes or pigments or both. There may also be various other additives to control specific characteristics such as rheological and wetting properties. The vehicle must not contain drying or semi-drying oils since the formation of a film or skin on the minute exposed areas around the ball would completely block off the ball, and prevent its rotation, or stop the flow of ink to the ball. For the same reason, the vehicle should not be volatile. The inks must be sufficiently stable to remain unaltered for long periods of time on the dealers' shelves, and must be able to stand long periods of exposure to temperatures up to 160°F., which may be encountered in show-windows or show-cases.

The colors used should have a permanence comparable with that of conventional writing fluids, and must be sufficiently dense in color to yield a sharply legible line with the minute quantities laid down by the ball. Such permanence can usually be obtained only by the use of pigments in which case the dispersion of the pigments must be sufficiently good to insure that the space around the ball (usually ¼ to 1 micron in width) will not become plugged by pigment agglomerates.

Dyes used in ball-pen inks must have a preferential attraction for cellulose fibers. otherwise the vehicle may diffuse through the paper carrying color with it and cause objectionable spreading, offset and strike-through.

It is important that the rheological properties of the ink be correct for the particular tip design used in order that the ink flow, viscosity drag on the ball, density of line and other writing properties are maintained at optimum values.

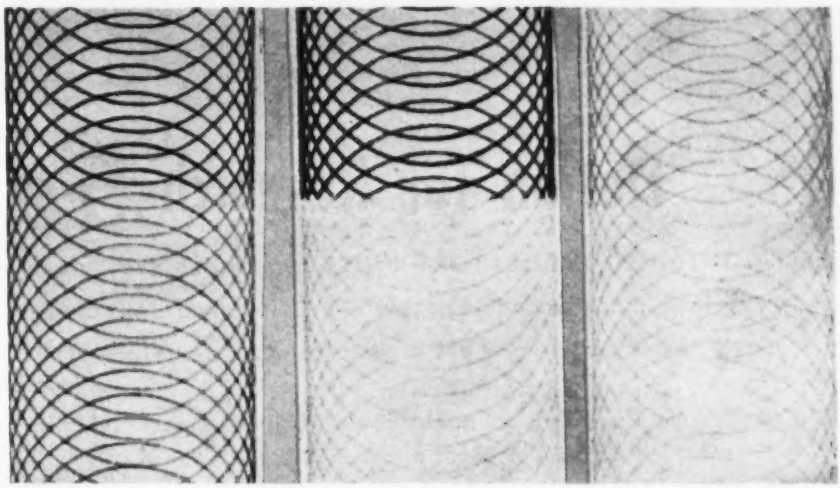
CHARACTERISTICS OF BALL-PEN WRITING

The character of the writing made with ball-pens differs markedly from that made with conventional pens. The volume of the ink laid down per unit area of paper surface averages a little more than 2. x 10^{-6} ml./cm.^{2} For ordinary aqueous writing ink the figure is about 1. x 10^{-5} ml./cm.^{2}

During use, changes caused by wear or accidental damaging of the writing tip profoundly affect writing characteristics. Such defects as failure to write, split lines, skipping, directionality (lines fainter in one particular direction), gooping (deposition of large droplets of ink), and change in density of line may result from these causes or from improper pen design or ink formulation.

In writing under normal fconditions there is a considerable difference between the linear speed of the point across the paper and the peripheral speed of the ball. This "slip" can become great enough, in the case of very smooth or glossy coated papers, to preclude the use of a ball pen, since the ball may not rotate at all or rotate so slowly that insufficient ink is carried around to leave a legible line. On normal writing papers the slip is sufficient to cause a distinct wiping action similar to that obtained in pencil writing.

The permanence of ball-pen writing varies widely. Practically all are completely unaffected by soaking in water. because the pigments and dyes used are insoluble in water. There is however, a great variation in the light permanence of inks now in use. Writing made with some ball-pens disappears after three hours' exposure in an accelerated fading unit, while others are still legible after one thousand hours' exposure. The fugitive nature of many ball-pen inks has led some organizations to prohibit the use of ball-pens for making permanent records.



Wide variations in light stability of inks is shown by 25 hours accelerated fading. Center and right are almost illegible, while left has lost no color after 9 hours.

The accompanying picture shows the light stability of writing made with some ball-pens now being sold. The samples were exposed in the National Carbon Co. Accelerated Fading Unit, Type XV, using "Sunshine" carbons and "Corex D" filter. This radiation qualitatively approximates natural sunlight[9].

STATISTICS

No official data have been published on the production or sales of ball-point pens but a 1947 Census of Manufacturers is now under way by The Department of Commerce, Bureau of Census, which will include data on ball-point pens[10]. The authors estimate, however, that the current annual production of ball-point pens is about 35,000,000 with a manufacturers' net selling price of $27,000,000.

Over one hundred companies have been making ball-pens or assembling them from purchased parts. Some companies make only ball-pens, some make also fountain pens, four or five companies accounting for the bulk of the ball-pen production.

The amount of ball pen ink produced is relatively small, and is estimated at about seven thousand gallons or fifty-eight thousand pounds per year. The inks are generally not made by ball-pen manufacturers, but are supplied by makers of printing inks, writing inks and specialties.

OUTLOOK

Eventually, it will be recognized that ball-point pens are *supplemental* to fountain pens and pencils, and the early sensational advertising and extravagant claims will be discounted. Each type of writing instrument will find its unique field of usefulness, as the properties and limitations of each become known.

With continued general improvements in ball-pens and bell-pen inks, there will probably be developments to serve special purposes, such as duplicating and erasable inks, and the business in replacable units will become more important.

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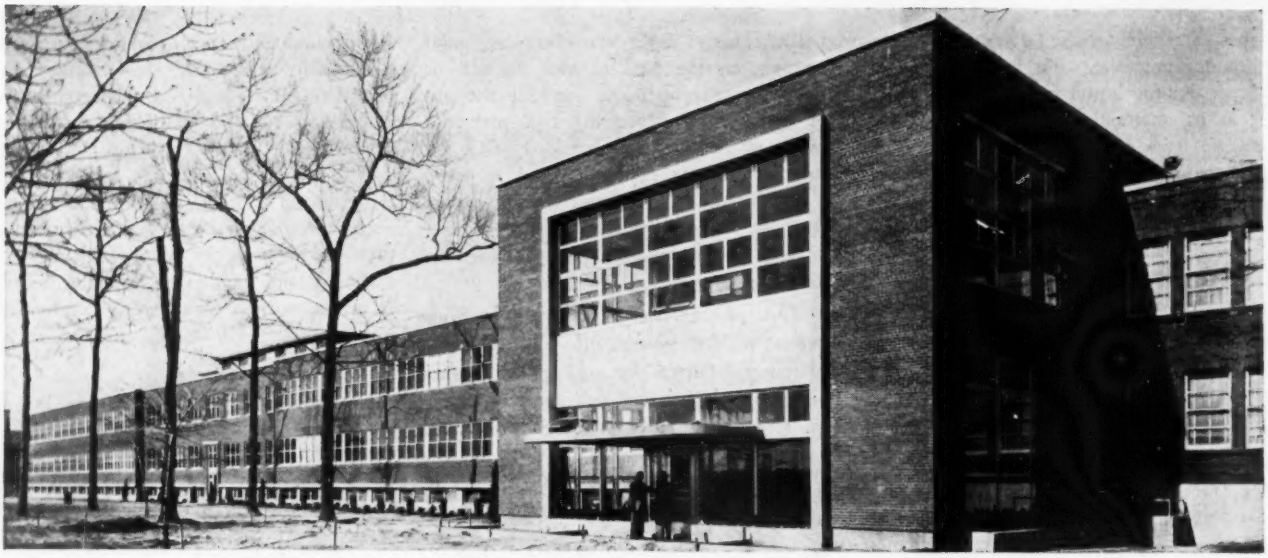


Design for Research

SELF-CONTAINED LABORATORY UNITS are among the unique features that mark Socony-Vacuum Oil Company's new chemistry and physics building for fundamental petroleum research.

MODERNLY designed with functionality as the primary consideration, Socony-Vacuum's new chemistry and physics laboratory embodies features which should be thoughtfully studied by any organization contemplating new research facilities.

The new building contains the main laboratories for most of Socony-Vacuum's fundamental research, and brings the total number of buildings in the company's Research and Development Department, at Paulsboro, N. J., to over a dozen. Comprising over an acre of working area, it is built and equipped to accommodate 120 chemists and 45 physicists; and it includes, in addition to laboratory space, a library staffed by 11 employees, administrative offices, control rooms, conference rooms, and a glass-paneled lobby.

AGGREGATION PRINCIPLE

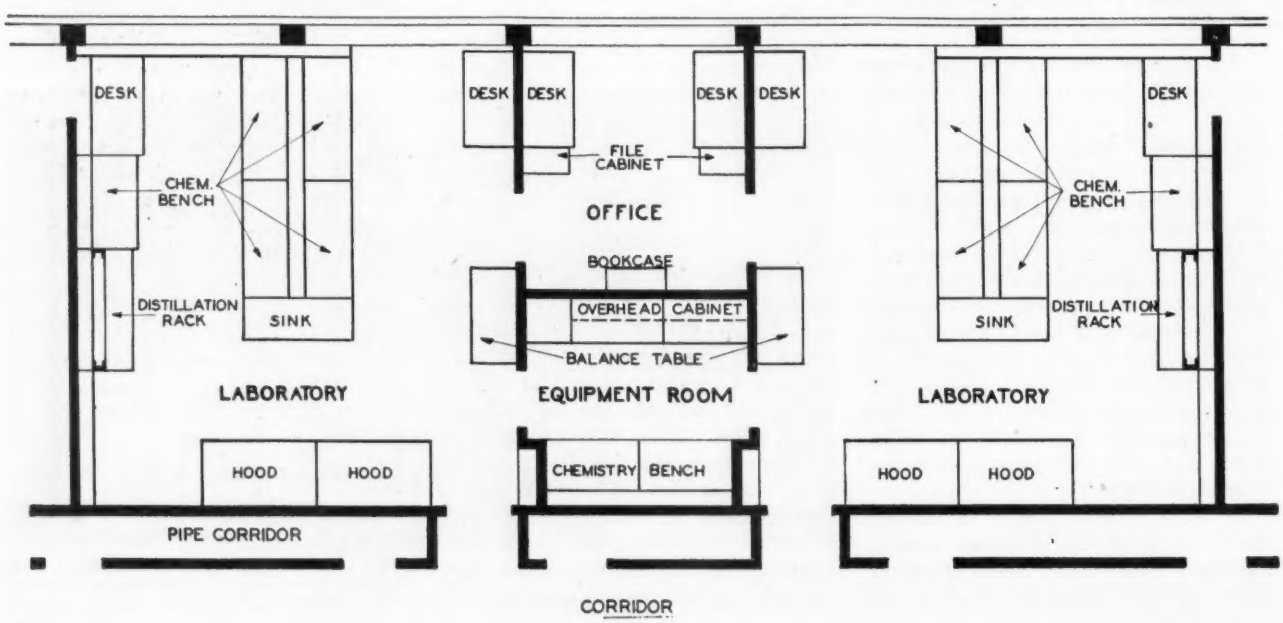
The building is actually an aggregation of self-contained units. Each of the scores of chemical laboratories on the basement, first, and second levels is equipped with its own exhaust system for removal of vapors and impure air. This arrangement, which eliminates the drifting of fumes from one laboratory to another through a central duct system, necessitates about 125 separate motors and blowers, located on the roof. Twelve-inch transite ducts connect the hoods to the blowers. Another unusual construction feature is the provision of doors—in the hallways outside each laboratory—to pipe shafts, allowing easy access to water, compressed air, steam, gas, and other service lines leading into the laboratories. Thus work in other laboratories can continue without interruption when services to one are cut off for any reason.

Two sizes of laboratories are standard: The larger ones are 19′ x 20′ and are suitable for two or three workers; the smaller are 10′ x 20′ and are intended for one or two persons. The larger rooms are interconnected by a small office and equipment room.

Filtered, conditioned air is supplied to many of the rooms; and no air is recirculated in the building from the laboratories.

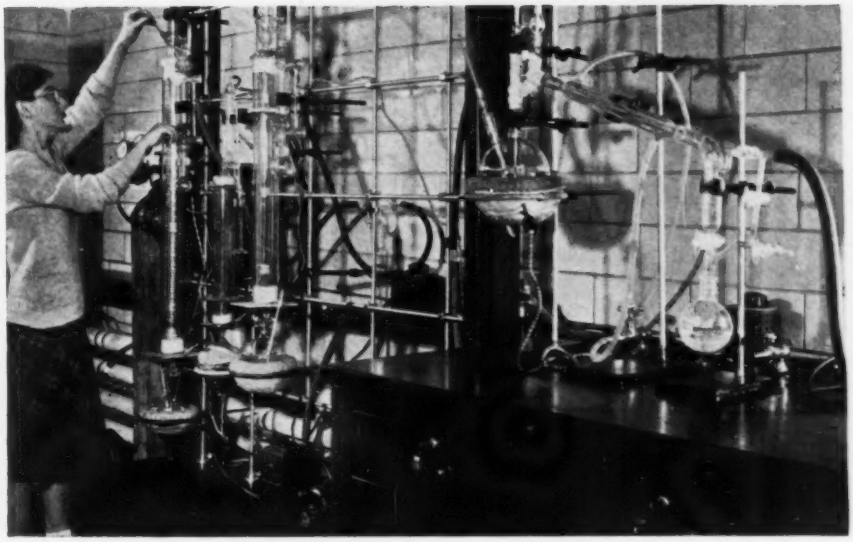
LABORATORY SERVICING

A physics machine shop and a glass-blowing shop service the laboratories.



Two cold rooms provide low-temperature conditions—one of them down to −20°C.; and separate refrigeration units provide flexibility in control. Two compressors, each with a capacity of 116 cfm at 20 psi, supply compressed air. Vacuum pumps handle 175 cfm, and oxygen and nitrogen are fed to the laboratories by a central system with tanks located in the basement. Steam is available in the laboratories at pressures from 15 to 400 psi. A central panel enables workers in each laboratory to select AC or DC electric current at various voltages. Stills provide 50 gph of distilled water, which flows through aluminum pipes and fittings.

Three large conference rooms provide for staff meetings. One seats over 100 and is equipped for motion-picture and slide projection, and with a public-address system.



A distillation set-up in one of the laboratories. Note that wall is of tile for easy cleaning. Laboratories, of two sizes, accommodate one to three workers.

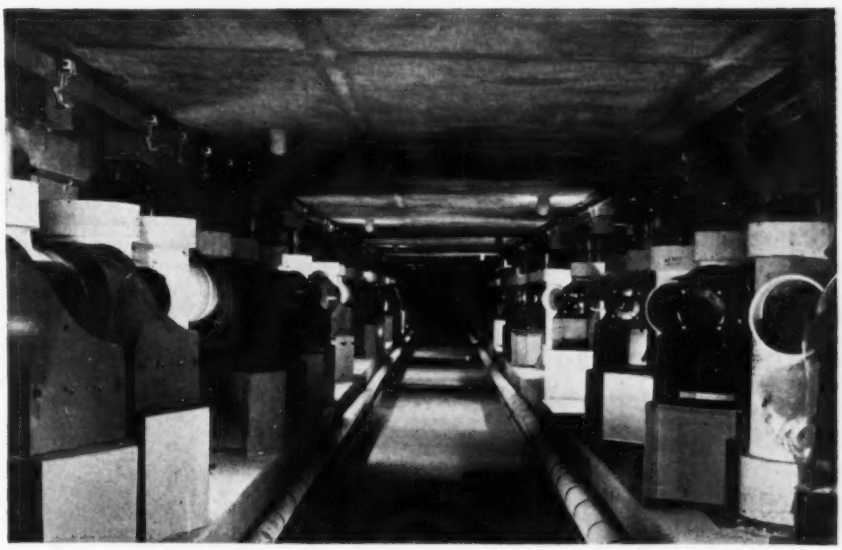
DURABLE AND CONVENIENT

Materials used throughout the building were chosen with an eye to convenience as well as durability.

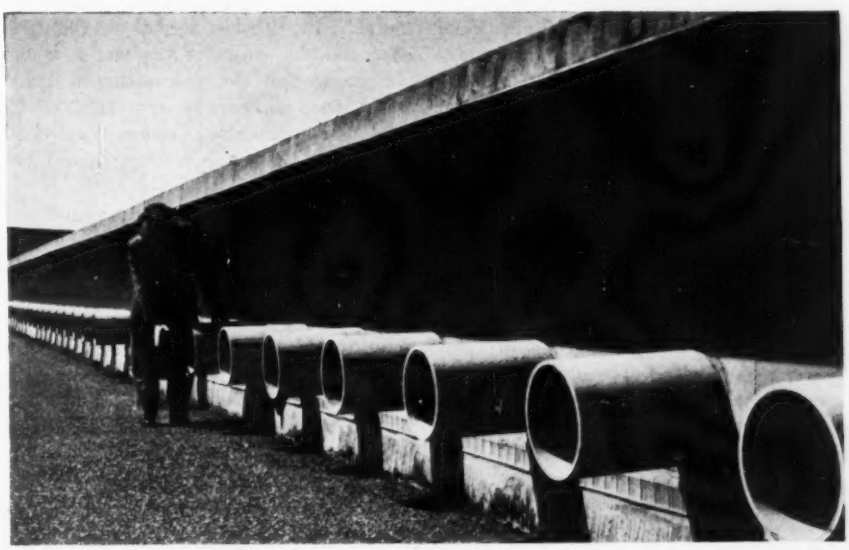
General construction is reinforced concrete with brick facing and continuous window bands. Laboratory and corridor floors are quarry tile; the walls, structural glazed tile for easy cleaning. Hoods, bench tops, and sinks are of all-stone construction. All ventilation ducts are aluminum. Fluorescent lighting is used throughout the building.

The laboratories are arranged, too, with an eye to convenience. In an article published several months ago (CI, December, 1947, p. 986) E. G. Rochow decries the old-fashioned laboratory set up and says, "In advanced research laboratories, there has been a gradual rearrangement of the familiar rectangular tables in order to bring within the reach of the individual research worker enough space and facilities for the more complicated and lengthier experiments which his work requires. For example, the straight-line sequence of desk-table-sink may be broken to form an L-shaped or U-shaped arrangement, in order to reduce the day's mileage."

Examination of the accompanying diagram shows that the Socony labs approach the ideal, with the worker sitting in the midst of his working area. His desk is at the window. At his side and behind him are the laboratory benches, together with the sink and a distillation rack for semi-permanent set-ups. The hood is a short step from the sink. The tile walls, the painted concrete ceilings, together with the fluorescent lighting and extensive window area, give the laboratory a light, airy appearance. "A laboratory does not have to be dreary," to quote Rochow again, "just because Kekule and Berzelius did their classical researches in such places."



Exhaust fans in the penthouse atop the laboratory building. Each laboratory has its own individual exhaust system, preventing drift of poisonous fumes from one room to another.



Each of these outlets on the roof of the building is connected with one of the exhaust fans. They are made of transite to forestall corrosion and weathering.

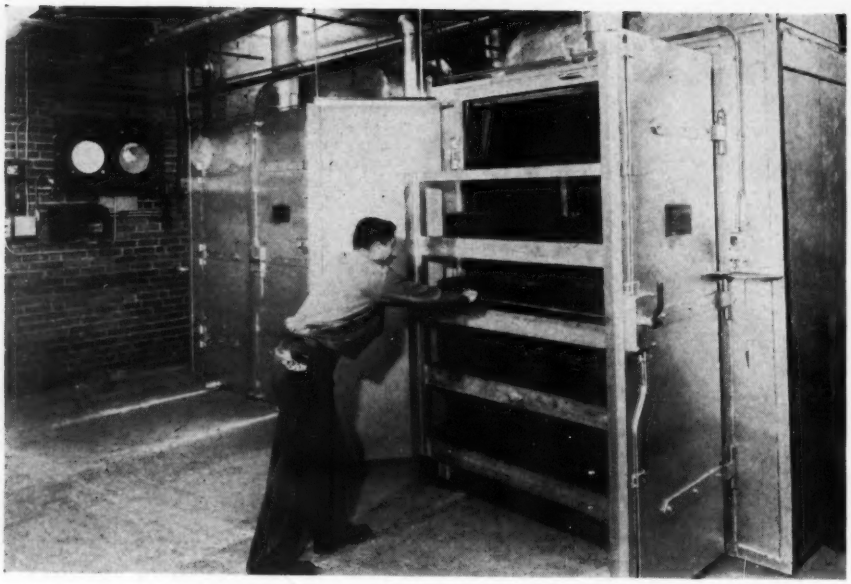


Figure 1—Instruments on the wall actuate heat controls of ovens during curing.

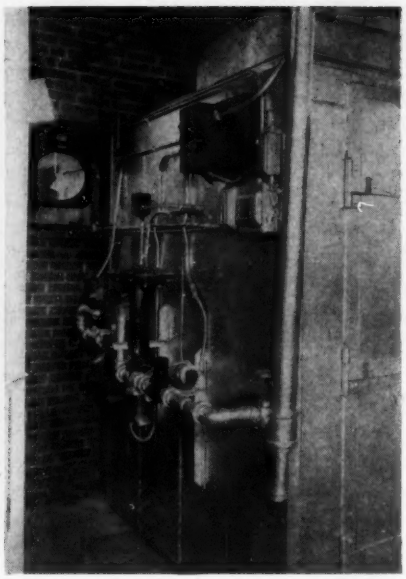


Figure 2—Controls located on oven side.

Controlled Heat Cures Heat-Cure Ills

by HERMAN GEHNRICH
Gehnrich and Gehnrich, Inc.
Woodside, L. I., N. Y.

AUTOMATIC-CONTROL OVENS OFFER SAVINGS in cost, manpower, and maintenance for curing processes in the rubber and allied industries.

MANY processors in the chemical industry requiring oven heats of 250-1150° F., and controlled heating cycles, have long been the victims of jerry-built equipment. In the recent installation of fully automatic curing ovens for a cutting wheel manufacturer, the Allison Company, Bridgeport, Connecticut, they may see the benefits in a sound engineering solution of their own heating problems.

A bank of five specially designed gas-fired truck-loading curing ovens, each completely equipped with pneumatic program control, has replaced 22 horizontal steam-jacketed curing ovens and five 10-hp steam boilers for vulcanization of rubber-bonded abrasive cutting wheels. The following advantages result: (1) a 33% saving in fuel; (2) a reduction in manpower required; (3) a reduction of maintenance problems almost to the vanishing point; and most important of all, (4) new freedom of control in the heating up, curing and cooling cycles.

CONTROL REQUIREMENTS

Since Allison manufactures cutting wheels of at least 200 different types in various sizes, the number of heating cycles involved in the vulcanizing or curing process is great. Over 20 different bonding materials, two principal types of abrasives in a wide range of grit sizes, and over 20 different types of fillers are employed. Wheels are made for both wet and dry usage. Therefore, it is not surprising that the vulcanizing temperatures range all the way from 110-200° C; and the vulcanizing times from 4-20 hours (total oven cycle times from 12-48 hours).

In some cases it has been found best to cure, sequentially, at two or three different levels of temperature. The first phase in the heating cycle is one of slow temperature rise to the vulcanizing level, requiring from 2 to 5 hours. During this period volatiles are given off (principally SO_2 arising from the sulfur involved in the vulcanization). The rate of evolution must be carefully controlled.

The vulcanizing time proper ranges from 4-20 hours and may be in several slow steps. In some cases, the temperature is subsequently leveled off for 2-8 hours at 50° less than the vulcanizing temperature. Finally, the rate of cooling, after vulcanization is complete, is slow and precisely controlled until room temperature is reached.

Dual instruments (shown on the wall in Figure 1) are employed for each oven, one recording the oven temperature (left) the other controlling the firing cycle by a circular-cam control disc (right). At least 12 such cam-type control discs are used to control the principal production cycles, some of which total up to 48 hours in length.

Burner controls and air-recirculation controls actuated by the equipment are located on the side of the oven (Figure 2). The burner control is fully modulating down to 2 lbs. of air pressure from the instrument. With air pressure below this point, one of the two burners on each oven cuts out, allowing the remaining burner to operate singly.

OVEN

The ovens developed by Gehnrich & Gehnrich, Inc., for the job are batch-type truck-loading ovens. Separation of combustion and working chambers by a partition set within the oven with an adjustable gap above and below, permits direct internal firing by two atmospheric gas burners and insures uniformity of temperature. Oven walls are of panel construction with mineral wool insulation,

and a minimum of through-metal. Operations involving long cycles, and slow heating and cooling seldom require the full capacity consumption of 250 cubic feet of gas per hour.

An interesting aspect of the cycle is that the fresh air inlet damper opens automatically to admit cool room air whenever the control instrument calls for removal of heat. Thus temperature overrides are eliminated. Also the cooling cycle is regulated in this way. The pneumatic diaphragm can be set to open the fresh air inlet damper when the instrument air pressure drops to a point below a limit set anywhere from zero to 7 psi.

ECONOMICS OF PROCESS

The 22 old horizontal steam-jacketed curing ovens formerly used were heated by steam from five 10-hp boilers and cooled by circulating water through the jacketing on the descending side of the cycle. The necessary 24-hour day entailed much more labor and maintenance than the completely-automatic gas-fired ovens. In addition, condensation within the oven caused rusting of the end plates that hold the wheels during curing. Since the end plates must be true flats, and many are used, they represent a high inventory, and their maintenance is an important cost factor. The life of clamping plates today is very much greater.

Cost of coal to fire the steam boilers was $240 per month. Cost of gas at not over $2 per day per oven for the four of the five ovens usually in use at any given time does not exceed $160 per month (for 20 working days).

Previously, three men were required to watch the boilers and manually manipulate the many valves required in regulating the cycles of the steam-jacketed ovens. The oven "loader" now does everything — clamping up the wheels in "sets," loading the racks, moving the truck into the oven, setting the oven controls, closing the doors, and forgetting the operation until the 18 to 48 hour cycle is finished. The savings in the maintenance work on steam piping cannot be estimated, but is great.

ADVANTAGES TO OTHERS

Allison's production department states that success of the new curing system has revealed research opportunities that should lead to better production methods and improved types of abrasive wheels. It is difficult to estimate how widely this can be applied, but it would appear that other industries employing curing or vulcanizing process—for brake linings, friction elements, abrasive-bearing articles, and molded rubber products — would benefit.

If the advantages of automatic control and precision firing realized by Allison were to accrue to others, the gain to industry would be tremendous.

Factors Governing the Performance of Anion Exchangers

by JOSEPH THOMPSON
and FRANCIS X. McGARVEY

The Resinous Products
and Chemical Co.
Philadelphia, Pennsylvania

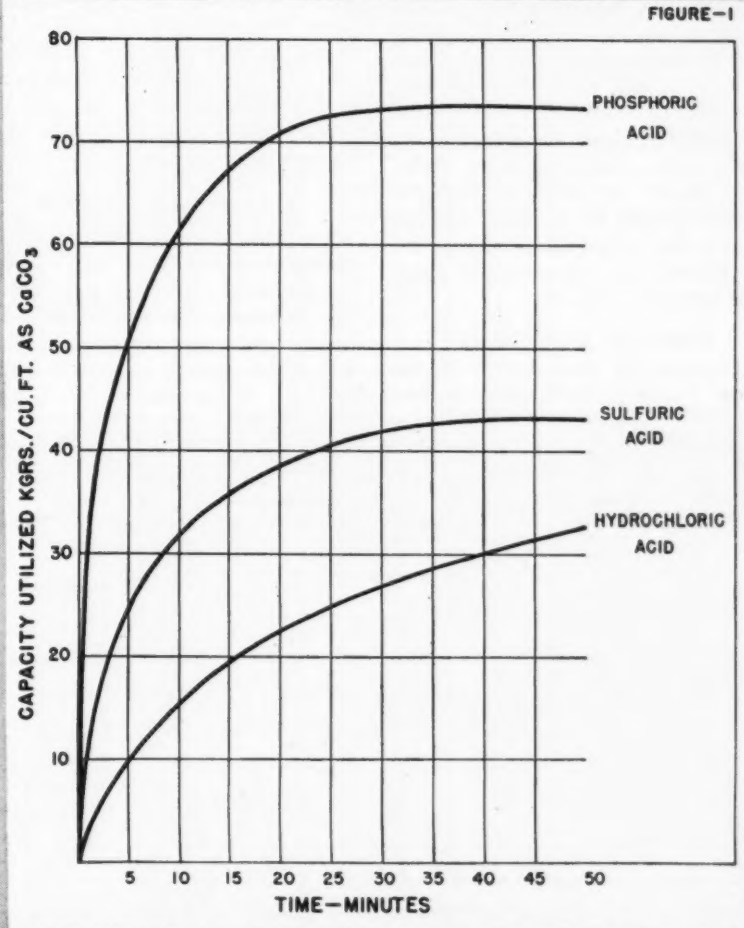
EFFICIENCY of synthetic resin ion exchangers depends primarily on valence of influent acid, regenerant, bed depth, and flow rate.

CHEMICAL process engineers can improve the efficiency of deionization operations by ion exchange through knowing the "why's" as well as "how" and "how much". Exchange capacity is greatest when the valence of the influent acid is high, the rate of flow is not above 3 gallons per cubic foot per minute, and the depth of the resin bed is at least 24 inches. For most efficient regeneration of the bed, caustic soda is the choice.

INFLUENCE OF ACID

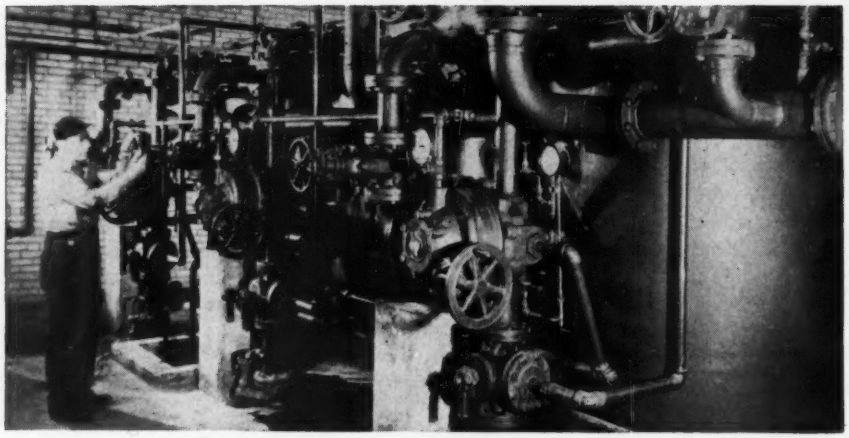
The influence of the acid to be removed on exchange capacity is shown by Figure 1, for which fixed quantities of the synthetic resin anion exchanger Amberlite IR-4B were stirred into 0.1 normal solutions of the acids. The rate of acid removal and the total exchange capacity increased greatly as the valence of the

FIGURE—1



INFLUENCE OF ACID TYPE ON EXCHANGE CAPACITY

Based upon data prepared for Eighth Annual Water Conference, Engineers' Society of Western Pennsylvania.



Commercial softening units replace scale-forming cations with sodium, employ Amberlite cation exchangers in the sodium form for efficient treatment of raw waters.

anion increased. Actually, because the acids in solution are in equilibria, a portion of the adsorption occurs at a lower valence form. For example, part of the sulfuric acid is exchanged as the monovalent radical $(HSO_4)^-$, while most of the phosphoric acid is exchanged as $(H_2PO_4)^-$.

Three practical conclusions, confirmed by column evaluations, can be drawn. Column capacity of Amberlite IR-4B should be greater for sulphuric acid than for hydrochloric acid, and it is about 50 per cent greater. Rate of exchange should be faster for sulphuric than for hydrochloric acid, and faster for phosphoric than sulphuric acid. Better quality water is invariably obtained when the influent contains more sulphuric than hydrochloric. Because of the greater affinity of the sulphuric acid for the resin, regeneration of a bed exhausted by this acid is more difficult than regeneration of hydrochloric-acid exhausted bed.

EFFECT OF REGENERANT

Regenerants for Amberlite IR-4B can be rated in order of efficiency: caustic, ammonia, soda ash, and sodium bicarbonate. Caustic-regenerated resin produces water with a lower anion content, probably because the caustic can remove bicarbonate ions while the soda ash cannot. Ammonia is less efficient because of its slight ionization.

BED DEPTH

Consulting engineers and manufacturing organizations generally limit the depth of the resin in a unit to a minimum of 24 to 30 inches. This is justified by the rapid drop in utilization of the bed at depths below 20 inches as shown in Figure 2. The depth at which no exchange is obtained is known as the "critical bed depth" and is controlled by the type of ion being exchanged.

OPTIMUM FLOW RATE

For optimum operation of anion exchangers adequate time must be allowed for contact of the water with the resin. The maximum flow rate is about 3 gallons per cubic foot per minute. The effect of flow rate on capacity is indicated by Figure 3. Operation slightly below the maximum flow rate insures complete utilization of the available capacity of the resin.

There is also a minimum flow rate, below which poor quality is obtained because of "ion-bleeding". This effect is clarified by examination of the following version of the anion exchange reaction:

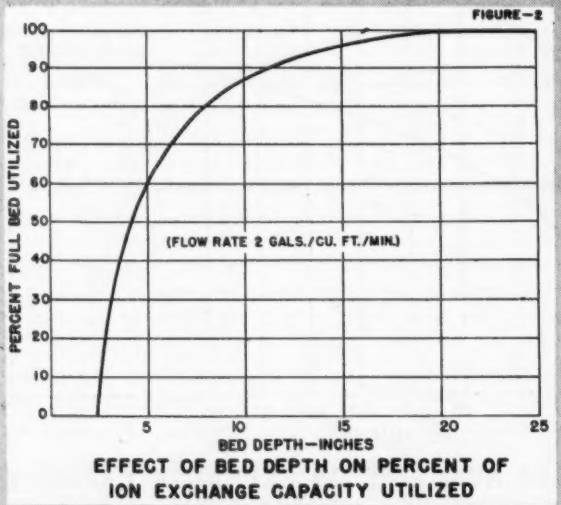
$$RNH_2OH + HX \rightleftarrows RNH_2X + H_2O$$

When a rapid flow rate is maintained, the equilibrium is dynamic and is forced to the right by the continual introduction of an excess of acid. At low rates, however, the equilibrium is static and acids are formed by hydrolysis of the resin. This allows acid to bleed into the liquid effluent.

A similar situation is often encountered in intermittent operation. When a partially exhausted system is allowed to stand idle and is then returnes to service, water of inferior quality results initially. In this case, the dynamic equilibrium maintained by excess of acid during service flow reverts in the idle period to a static equilibrium. The resin hydrolyzes, forming the acid which appears in the effluent when flow is resumed. The volume of the acid water is roughly equal to the voids in the resin bed.

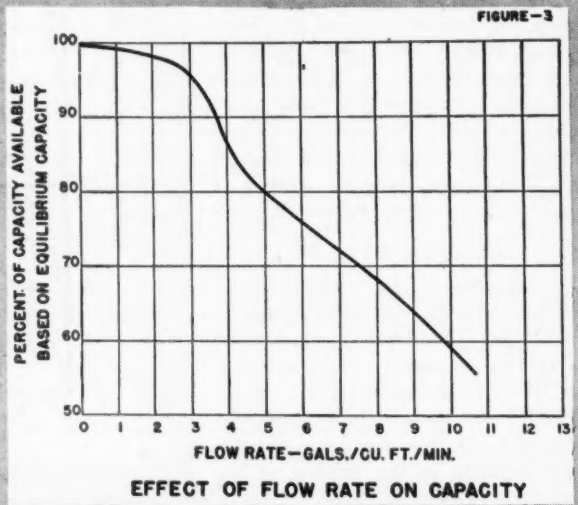
Immediately after this water is displaced, the quality of the water rises to a point comparable to that at the beginning of the run although the resin had been partially exhausted before shutdown. The diffusion of the ions from the surface to the interior of the resin particle determines the rate of exchange. As the cycle progresses and the surface of the particle becomes exhausted, the rate of exchange decreases. In the idle period, the concentration of ions equalizes throughout the particle, leaving the surface relatively free of ions. A high rate of exchange is then obtained in renewed operation.

FIGURE—2



EFFECT OF BED DEPTH ON PERCENT OF ION EXCHANGE CAPACITY UTILIZED

FIGURE—3



EFFECT OF FLOW RATE ON CAPACITY

THE CHEMICAL PANORAMA

NEWS OF THE CHEMICAL PROCESS INDUSTRIES IN PICTURES

PEOPLE

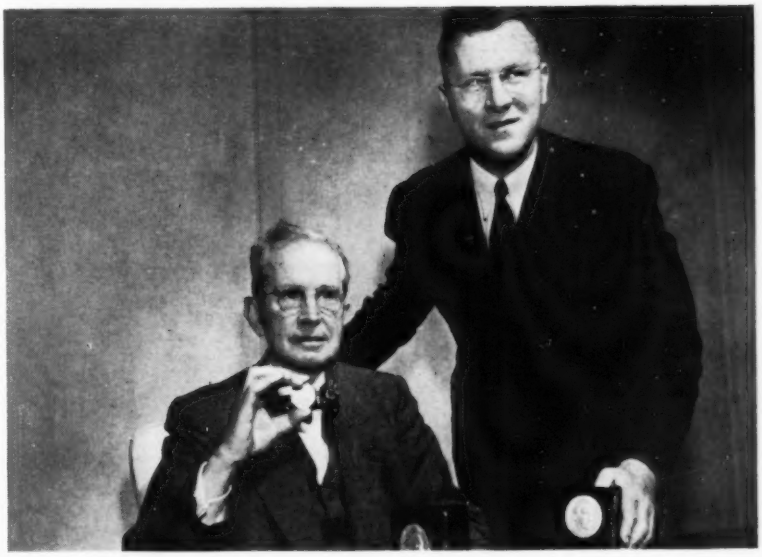
G. Theodore Barks, appointed general superintendent of Monsanto Chemical Co.'s new vinyl chloride production unit.

P. D. Peterson, who has recently joined the staff of the Stauffer Chemical Co., as technical director of agricultural sales.

Arthur R. Broadman, recently elected assistant vice-president of the Heyden Chemical Corp.

Frederick H. Weismuller, named general manager of the Pigments Dept., Du Pont Co. He succeeds John F. Daley, who has become general manager of the Organic Chemicals Dept.

E. W. Engstrom, v.p. of research, RCA labs, elected president of the Industrial Research Institute, Inc.



George Oenslager (l.) and W. L. Semon, awarded the Charles Goodyear memorial medals for outstanding scientific contributions to the rubber industry.

Norton Company Builds New Lab

The Norton Co., Chippewa, Canada, now has the largest and most modern laboratory in Canada devoted to abrasive materials. The company makes aluminum oxide, silicon carbide, boron carbide, magnesium oxide, and kindred special carbides and oxide mixtures, such as spinel. Laboratory personnel carry out basic and applied research on raw materials, plant processes and electric furnace techniques. Laboratory facilities include the latest equipment for physical testing of grain strength, refractory characteristics, hardness, grain structure, strength of pressure-molded boron carbide, etc.

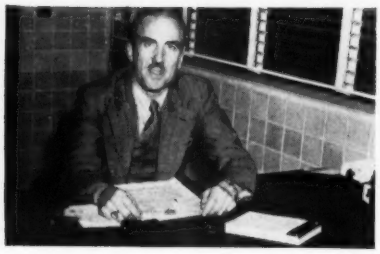
The processed crudes made here are next shipped to finishing plants in Worcester, Mass., Hamilton, Canada, England, and other parts of the world.

The Norton Co. originated boron carbide, the hardest material next to the diamond known to man.

A physical testing laboratory for testing refractory characteristics, such as hardness. Here is equipment for making photomicrographs for studying crystalline structure.

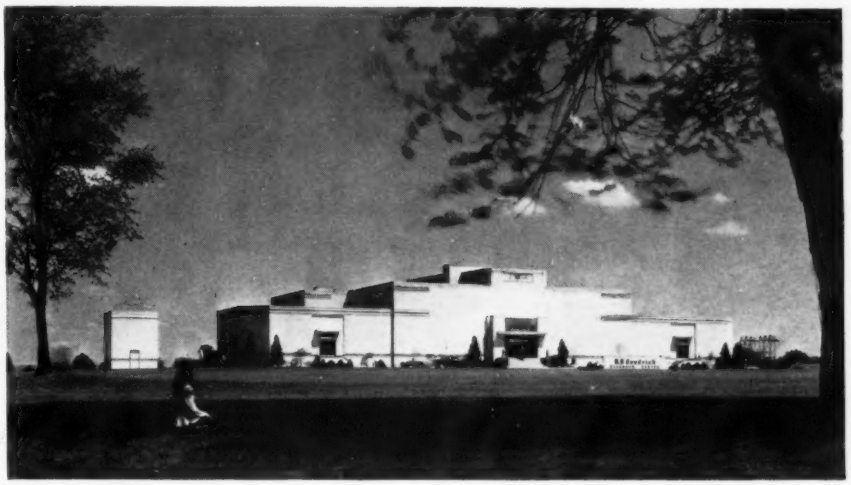
A balance room for analytical and pilot plant studies. In this room are various instruments for measuring physical properties.

An analytical laboratory where relatively complex analyses dealing with refractories are carried out. The ceiling is soundproofed.



These are some of the executives of the laboratory. At the left is A. H. Ballard, director of research. At the top, left to right are Guy H. Fetterley and Fred H. Young. At the bottom, left to right, are Wallace M. Hazel and John A. Upper.

Assembly hall of the Research Center. The hall is in the three-story main building and seats 250 people. Here John L. Collyer (center), company president, is addressing a group of company officials and research and technical men at the inaugural ceremonies.



Main laboratory building. This contains 81 individual laboratories, a cafeteria, the assembly hall, and a 10,000 volume library, largest of its kind in the world.

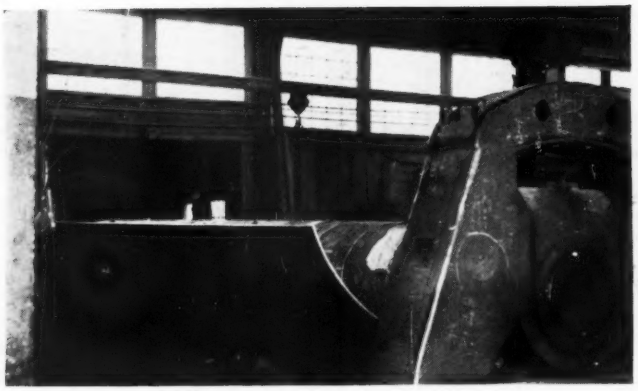
Rubber Research

The B. F. Goodrich Co. recently opened a multi-million dollar research center at Brecksville, Ohio, midway between Akron and Cleveland. The center comprises six buildings on a 261-acre site, and the company believes that it will make it possible to bring scientific discoveries to maturity there or four times faster than at present. The new lab supplants research facilities that were at the Akron plant.

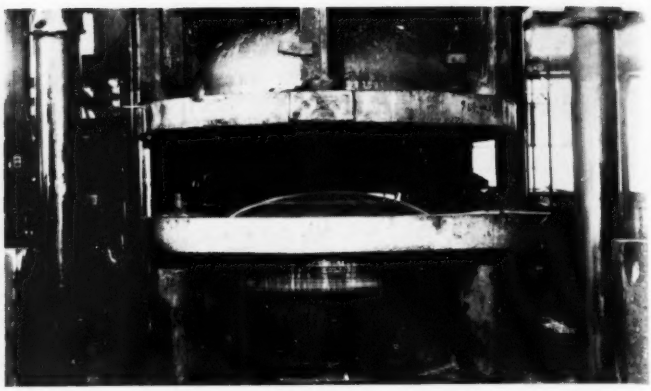
In addition to making studies of crude and man-made rubber, Goodrich will conduct intensive research in such fields as chemicals, plastics, agriculture, horticulture and the application of nuclear energy to rubber manufacturing.

One section of the main laboratory. The building has windows only at the ends of the hallways, and has indirect liighting and air conditioning.

Here material is being tested for radioactivity with a Geigar counter. The lab has the latest scientific tools.



Aluminum tank sheets are rolled to contour after being beveled.



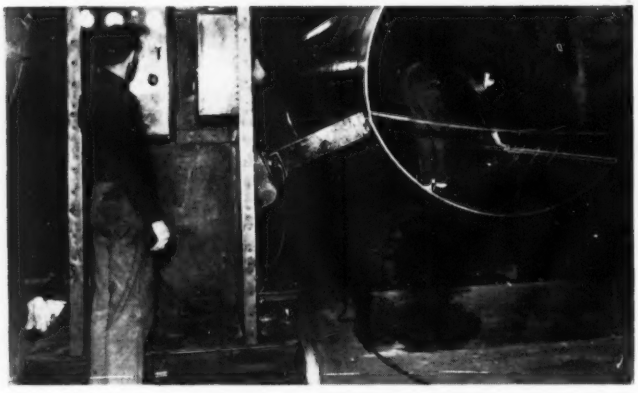
Pressing of the aluminum tank head by an 1,100 ton hydraulic press.

Glycerine Cars

The American Car and Foundry Co. has just completed thirty-six aluminum 8,000 gallon tank cars for the Shell Chemical Co. These are the first tank cars built especially for the transportation of synthetic glycerine, whose major uses will be in the manufacturing of semi-plastics for the automobile industry, for a corrosion-resisting paint and for moisturizing tobacco.

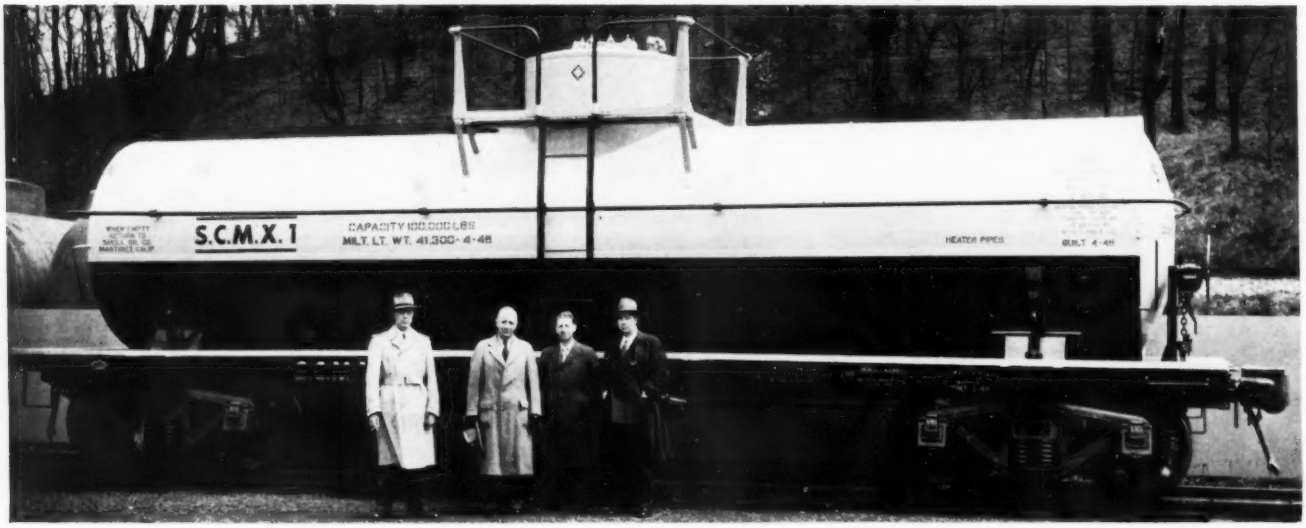
The tanks are of all-welded construction and have welded underframes. They are equipped with eight lines of 2" heater coils to keep the lading liquid for quick unloading. A special gas-shielded arc process for welding is used in their construction.

Tack welding of longitudinal seam by the argon gas-shielded process.



The seams are x-rayed throughout to insure perfect workmanship.

Two inch Fiberglas insulation assures even temperature in transit.



J. D. Seiler, W. P. Hindman, C. Wright of Shell Chemical and R. Slater (left to right), inspect one of the finished tank cars.

A Helping Hand for METAL TREATING

In the treating of metal for corrosion resistance, phosphoric acid and other specially developed compounds are widely used by manufacturers of automobiles, telephones, washing machines, water heaters, stoves, etc. Solutions containing Victor* Phosphoric Acid form effective, rust-retarding phosphate coatings on iron and steel surfaces, and provide a more perfect bond between the paint and metal.

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1948

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53, 54, 55, 62, 63, 64

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Victor chemicals used in metal treating, cleaning, plating, polishing and the manufacture of alloys include:

Ferrophosphorus . . . manufacture of special steels and foundry iron.

Oxalic Acid . . . cleaning railroad cars, brass polish, rust-proofing

Phosphoric Acid . . . metal cleaning compounds, rust-proofing, railroad car cleaning, electro-polishing.

Sodium Phosphates . . . cleaning compounds, tin plating, degreasing.

Wetting Agents . . . accelerate action of cleaning compounds.

Hemisodium Phosphate . . . contact tinning of brass.

Phosphorus . . . manufacture of phosphor-copper.

Sodium Acid Pyrophosphate . . . contact tinning.

Sodium Formate . . . plating baths.

VICTOR CHEMICAL WORKS
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NEW PRODUCTS & PROCESSES

Magnesium-Based Lube Additive NP 695

A magnesium-type detergent-dispersant for compounding premium and heavy-duty lubricating oils is manufactured by Monsanto Chemical Co. The new additive, designated Santolube 222, imparts a high degree of detergency at a relatively low concentration.

This is believed to be the first magnesium-type detergent oil additive made commercially available. Because of its lower ash content and potent detergent properties, Santolube 222 has been found more effective than many more expensive detergents based on heavier metals.

In suitable base oils Santolube 222 at 1.0% by volume with 0.66% by volume of Monsanto's oxidation inhibitor Santolube 394-C, meets U. S. Army Specification 2-104B.

Low-Cost Styrene Copolymer NP 696

A new low-cost high-styrene copolymer resin called Darex Copolymer X43 is offered by Dewey and Almy Chemical Co. Available from large-scale production, this new rubber chemical was especially developed for stiffening GRS synthetic rubber in the manufacture of high-grade shoe soles. It has proved satisfactory in factory trials, and is also valuable in wire insulation, extruded goods, fabrics and paper coatings, adhesives and plastic moldings.

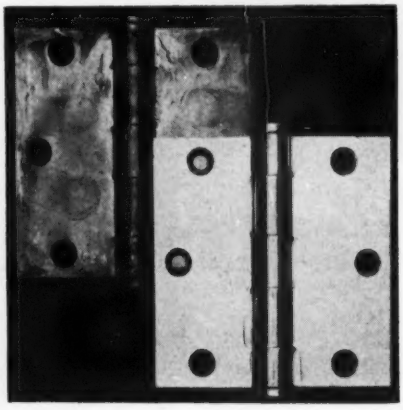
Shipped as light-colored granules, Darex Copolymer X43 has a low specific gravity of 1.05 and low mooney plasticity of 20 to 40 at processing temperatures of 212 to 250° F.

Increased hardness and stiffness, resistance to water absorption, good compressive set and excellent electrical characteristics are some of the properties imparted by this resin to natural and synthetic rubbers. When used as a reinforcing filler for GRS, X43 gives increased abrasion resistance, higher modulus and improved flex-life. Small amounts improve handling in mixing, calendering and molding of stocks highly loaded with mineral pigments.

Aid For Bright Nickel Plating NP 697

A new additive, Actane, for use in acid dips prior to plating is being made by Enthone, Inc.

Its function is to disperse and remove



colloidal films from the surface of metals that may be deposited during cleaning and which cause the plate to be spotted, streaked, or stained. The results are said to be particularly beneficial for dipping of non-ferrous metals such as copper and brass prior to bright nickel plating.

The photograph illustrates the results obtained in actual production for bright nickel plating upon brass. Prior to use of Actane in the acid dip, the brass hinges came out of the bright nickel streaked as shown. One ounce per gallon of Enthone "Actane" was added to the acid dip in the cycle and no other changes were made. The plate obtained is illustrated by the specimen on the right.

Vinyl Printing Inks NP 698

A complete line of vinyl printing inks is being made by American Resinous Chemicals Corp. The line includes clear vehicles, thinners, light-fast non-cracking pigment concentrates, delustre coats, and dye solutions. All are available for various methods of application, including rotogravure and silk screen printing, as well as hand topping, or spanishing on film or vinyl-coated fabric.

Benzotrifluoride NP 699

The Hooker Electrochemical Co. announces the pilot plant production of benzotrifluoride (trifluoromethylbenzene). This new compound is of potential interest as an intermediate in the preparation of dyestuffs and other chemicals. It has excellent thermal stability and good dielectric properties.

Benzotrifluoride is a water-white aromatic liquid which is completely miscible with most common solvents. The trifluoromethyl (CF_3) group is generally strongly meta directing. Its distillation range is 2° including 101°C; freezing range is from −28.5° to −29.5°C; specific gravity at 15.5°C is 1.197.

Bromine-Containing Methanes NP 700

Michigan Chemical Corp. is in pilot-plant production of a new series of bromochloromethanes, including bromodichloromethane, bromotrichloromethane, dibromochloromethane and dibromodichloromethane.

These halogenated compounds are of unusual interest at the present time as they are believed to be generally useful in preparing polyhalo-compounds by addition to olefins, a recent development. It is known for example, that bromotrichloromethane combines with octene-1 to form 1,1,1,-trichloro-3-bromononane in good yields.

Polyhalo-compounds prepared by this reaction may be subjected to hydrolysis, fluorination to corresponding fluoro-compounds, and in other reactions common to organic halides.

The bromochloromethanes are known to influence the course of polymerization reactions and are high density liquids

CHEMICAL INDUSTRIES TECHNICAL DATA SERVICE

CHEMICAL INDUSTRIES, 309 W. Jackson Blvd., Chicago 6, Ill. (7-8)

Please send me more information, if available, on the following items. I understand that nothing further may be available on some of them.

NP695	NP699	NP703	NP707	NP711
NP696	NP700	NP704	NP708	NP712
NP697	NP701	NP705	NP709	NP713
NP698	NP702	NP706	NP710	NP714

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Company.....

Street.....

City..... Zone..... State.....

Columbia's plants and those of its affiliate, Southern Alkali Corporation, are favorably located and are integrated with well organized distribution facilities.

Carefully controlled processes assure consistently high product standards . . . efficient handling and shipping procedures safeguard deliveries.

Equally important—Columbia policies contribute to enduring business relationships.

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✓ Adhesives
✓ Protective Coatings
✓ Saturants

POLYVINYL ACETATE COPOLYMERS IN SOLUTION FORM

Water White
Tough, Flexible Elastomers
Non-Yellowing, Non-Oxidizing

Resistant to Water
Oils
Aliphatic solvents

	% Solids	Vehicle	Wt./Gallon
POLYCO 265	70-75	Acetone	8.7 lbs.
POLYCO 301	55-60	Toluol	8.6 lbs.
POLYCO 309	70-75	Ethyl Alcohol	8.7 lbs.
POLYCO 310	55-60	Xylol	8.6 lbs.

Compatible with	May be Plasticized with
Nitrocellulose	Dibutyl phthalate
Phenolic Resins	Santicizer B-16, M-17
Chlorinated Rubber	Arochlors
Alkyds	Tricresyl phosphate
Nevillac Resins	Kronisol
Santolite Resins	Ethox

Uses

In laminating compositions for cellophane, acetate, paper; heat seal coatings; metal and cloth lacquers; oil resistant paints; transparentizing paper; adhesives; caulking compounds; pipe thread sealants.

POLYCO

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suitable for gauge fluids and for mineral separation. They are also likely to find other uses as chemical intermediates.

Camphene NP 701

Camphene, the only crystalline dicyclic hydrocarbon occurring in nature, is now in volume production by the Glidden Co.'s Naval Stores Division.

Although camphene occurs in many naturally occurring essential oils its commercial source is alpha-pinene, obtained by fractionation of one of the turpentines. Camphene is produced in large volume as an intermediate in the production of synthetic camphor, but previous to Glidden's production it was generally available only as an expensive laboratory curiosity. Now that camphene is available in carload and tank-car volume it is expected that other uses will be developed for this reactive terpene in the synthesis of novel and useful products.

Methacrylic Acid NP 702

Monomeric methacrylic acid is now being made by the Rohm & Haas Co. in commercial quantities. Supplied as a 40% aqueous solution, this acid has a purity of better than 96% and a polymer content of less than 0.1%.

A concentrated aqueous solution of methacrylic acid may be obtained by fractional distillation, and the anhydrous acid can be prepared by solvent extraction of the aqueous solution.

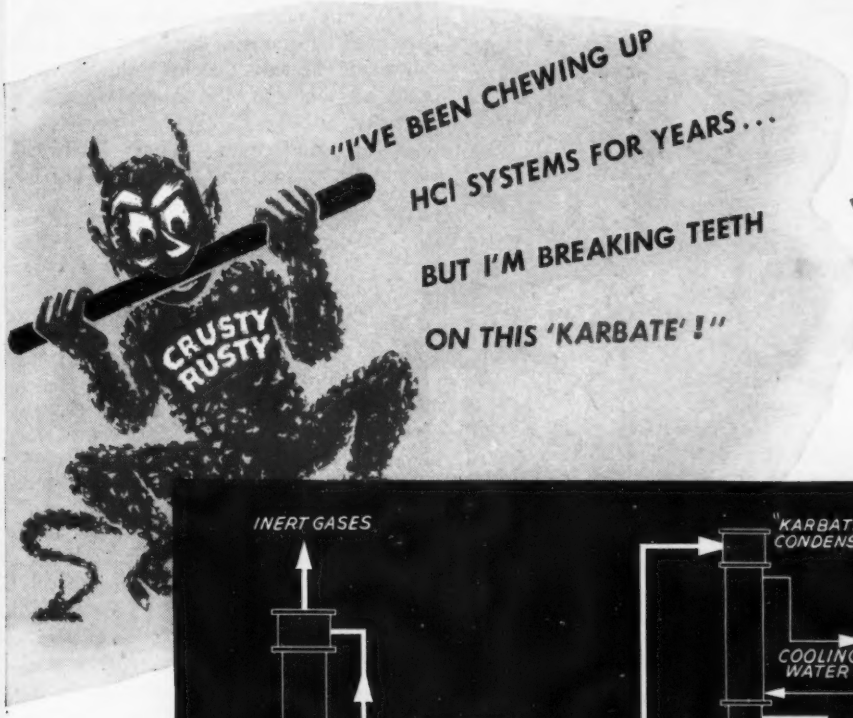
Methacrylic acid polymerizes readily to give, under most conditions, a water-soluble polymer. It may be copolymerized with other monomers to give alkali-soluble polymers. Small amounts of free acid groups in polymers are reported to improve adhesion of the polymers in some instances when used as coatings.

In addition to its use a monomer, the reaction double bond and free carboxyl group of methcrylic acid may be utilized in chemical synthesis; for example, for the preparation of substituted isobutyric acids by addition to the double bond, or for the preparation of special methacrylic esters by esterification, where the preferred preparation by transesterfication of methyl methacrylate or directly from acetone cyanohydrin is less attractive. Preparations of methacrylyl chloride and methacrylic anhydride are also possible from the acid.

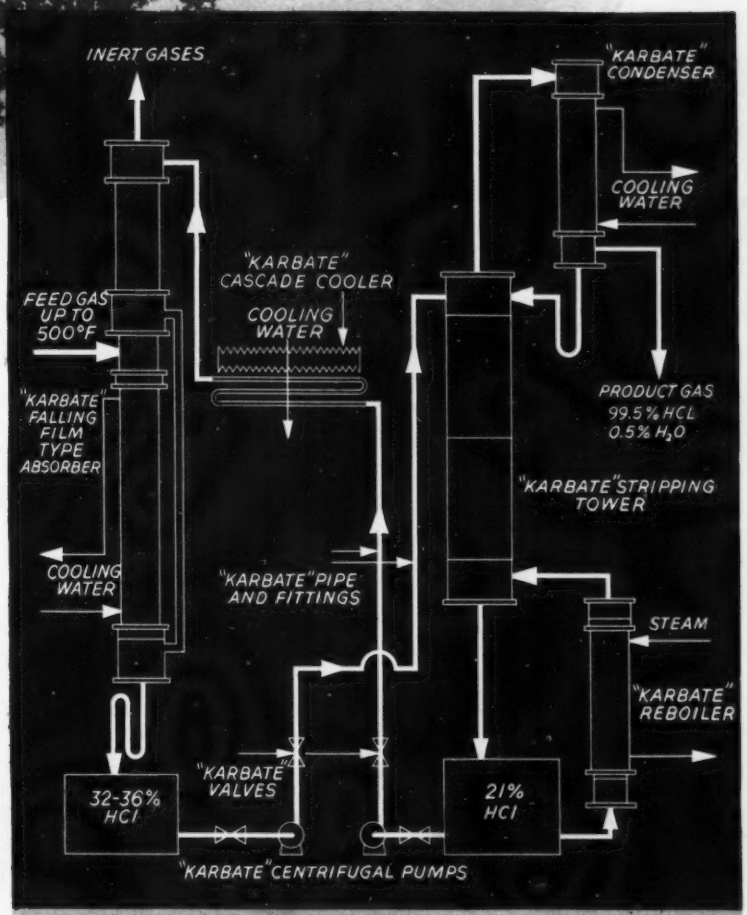
Adsorption Deodorant NP 703

A new deodorant, Odorid, which is being marketed by the American Processing Co., is claimed to be the only deodorant that works on the principle of surface adsorption. Other types of deodorants on the market today either send forth an odor to mask the unpleasant odor, or serve to desensitize the olfactory

MAKE ANHYDROUS HCl?



Whip corrosion with "KARBATE" Impervious Graphite Equipment!



A typical flow sheet of one system for producing anhydrous HCl from feed gases up to 500 deg. F. containing inert gases.

IF YOU manufacture anhydrous HCl for use in the production of plastics, alkyl chlorides, synthetic rubber, or other materials, you can eliminate corrosion permanently by using "Karbate" Impervious Graphite corrosion-resistant equipment. The *entire* system can be assembled of *standard* "Karbate" units, including acid absorbers, cascade coolers, towers, heat exchangers, pipe, valves, condensers, pumps, tanks, and fittings. This equipment has the following advantages:

1. **Chemically inert to all concentrations of HCl**
2. **Very high heat-transfer rate**
3. **Light weight with adequate strength**
4. **Immune to thermal shock**
5. **Resistant to mechanical shock**
6. **Easy to machine and install**

For more details on the use of "Karbate" Impervious Graphite in producing anhydrous HCl, write to National Carbon Company, Inc., Dept. CI.

These products sold in Canada by Canadian National Carbon Company Ltd., Toronto 4, Canada

The term "Karbate" is a registered trade-mark of

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

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Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

All grades of INDONEX Plasticizers are compatible with a wide range of resins including various phenolics, modified phenolics, alkyds, acrylates, polyamides, cellulose derivatives, coal tar and petroleum resins, polystyrenes, rosin derivatives, and waxes. Many diverse applications as plasticizers, modifiers, or extenders are indicated. (Circular 105.)

INDONEX VG is a medium-colored partial replacement for dioctyl phthalate, tricresyl phosphate, etc., in vinyls. (Circular 101.)

INDONEX Plasticizers 633½, 634½, 638½ have found many applications in compounding of GR-S, Natural Rubber, Neoprene, Butyl and Acrylonitrile Copolymers. (Bulletin 13 and special circulars.)

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Grade	633½	634½	638½	VG
Color	Dark	Dark	Dark	Medium
Flash °F.	450	460	510	460
Pour °F.	35	40	70	20
Viscosity 210 °F., Saybolt sec.	110	125	510	103
Evap. Loss mg/10g (1 hr. 100° C.)	5	5	3	4

INDOIL® CHEMICAL PRODUCTS

STANDARD OIL COMPANY (INDIANA)
CHEMICAL PRODUCTS DEPARTMENT
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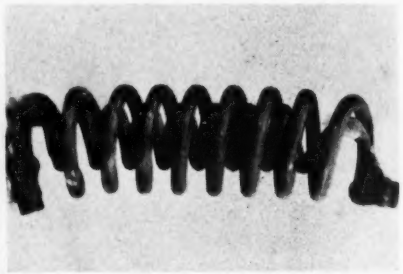
nerves of individuals near the deodorant.

Odorid is an odorless powder. It gives off no chemical substances and is nontoxic, noncaustic, and noncorrosive. It may be safely used dry or mixed with water.

Coil Cleaner NP 704

A new liquid dissolves lime scale and renews the efficiency of hot-water coil-equipped apparatus or hot-water tanks of automatic heaters, thereby restoring the coil or tank to its original heating capacity.

The manufacturer, Allied Products Company, reports that Corodex Coil Clean



will completely dissolve all lime and mineral deposits from copper, brass, bronze, iron or steel or stainless steel coils.

Corodex Coil Clean is non-explosive, non-inflammable and will not injure the metal or the hands of the user. It is available in any quantity from 1 to 55 gallons.

Plastic For Insulation NP 705

A thermoplastic material that is tough, light in weight and easy to form into compound shapes, is being manufactured by United States Rubber Co. It is noncorrosive and stable under changing atmospheric conditions, with electrical insulating properties and a low rate of heat conductivity.

Because of its high impact strength, its low water absorption and good insulating properties, it is being used for a new type of shipping container for dry and frozen foods, as well as in home freezers, commercial freezing units and other products. Future planned applications include luggage, radio cases, and component parts for boats, automobiles, busses, airplanes and trains.

The material, known as Versalite, can be formed into irregular and compound shapes as large as five feet by ten feet. It can be made in almost any thickness above .020 inches. It can have solid color throughout, with dull, satin, gloss or embossed finish. It will not chip or warp and is highly resistant to gasoline, oils and most commercial cleaners.

Because of its ease in forming, it opens new fields for elaborate designs without

FROM SHELL CHEMICAL...
an increased supply of

Methyl Ethyl Ketone

To help meet the needs of industry, Shell Chemical has recently placed "on-stream" at Houston, Texas, its third MEK plant. With this phase of its postwar expansion completed, one more important step has been taken toward providing industry with adequate supplies of high quality organic chemical products.

MEK has been found to be outstanding as an active solvent for nitrocellulose lacquers, as well as for fabric and surface coatings based on the various vinyl resins. It is also successfully used in the manufacture of adhesives and cements which utilize Buna-N and neoprene rubber.

Other important products in which MEK finds application are can coatings, paint and varnish removers, rubber chemicals and printing inks.

LACQUER SOLVENT PROPERTIES

Dilution Ratio	
Toluene	4.4
Aromatic Petroleum Naphtha	1.4
Aliphatic Petroleum Naphtha	0.9
Viscosity (8% RS ½ second Nitrocellulose solution at 25°C)	10 centipoises
Blush resistance (% relative humidity at 80°F)	45%
Rate of evaporation (normal butyl acetate = 1.0)	4.6

A letterhead request to any of the Shell Chemical offices listed below will bring you technical literature and a sample.

Among the many other Shell Chemical products are Methyl Isobutyl Ketone, Methyl Isobutyl Carbinol and Tertiary Butyl Alcohol

SHELL CHEMICAL CORPORATION

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Los Angeles • Houston • St. Louis • Chicago • Cleveland • Boston • Detroit

WE'VE DONE IT FOR THE RUBBER INDUSTRY...

IN the early days of synthetic rubber manufacture, that industry faced many unusual problems. Among them was the problem of ODOR . . . odor which carried on through the various manufacturing processes and even into the finished, fabricated products. Thus, hundreds of these synthetic rubber articles reached the dealers' outlets handicapped by their none-too-pleasant odor. Quick to take action once it was realized that here was a condition harmful to sales, both manufacturers and fabricators sought solution in the field of aromatics. The rubber and latex masking agents originated in our laboratories during this period and since further perfected, served effectively and at negligible cost to remove this problem of odor as an obstacle to sales . . . Now your industry may be wholly unlike the synthetic rubber industry, yet somewhere along the line it, too, may be handicapped by a problem involving odor. I so, please bear in mind that having solved this problem for other industries . . .

PERHAPS WE CAN DO IT FOR YOU!...

Certain of your processing operations may be producing conditions unfavorable to the health or efficiency of your plant personnel. Or like the synthetic rubber products, your merchandise may retain unpleasant residual odors detrimental to sales. Or again, your product might be made to stand out head and shoulders above competitive merchandise by the simple addition of an appealing fragrance. Of course, the possibility or advantage of using odorants or deodorants in your particular field may not be immediately apparent, but the fact remains that hundreds of large organizations and important industries *are* utilizing the principle of odor-modification today to improve plant conditions or to increase sales. On the chance that we can help YOU, why not drop us a line describing your problem . . . *today?*

FRITZSCHE *Brothers, Inc.*

Est. 1871

PORT AUTHORITY BUILDING, 76 NINTH AVENUE, NEW YORK 11, N. Y.

BRANCH OFFICES *and* *STOCKS: *Atlanta, Ga., *Boston, Mass., *Chicago, Ill., Cincinnati, O., Cleveland, O., Dallas, Tex., Detroit, Mich., *Los Angeles, Calif., Philadelphia, Pa., San Francisco, Calif., *St. Louis, Mo., *Toronto, Canada and *Mexico, D. F.
FACTORY: *Clifton, N. J.*

expensive tooling. It also eliminates expensive finishing operations.

The rubber company controls the making of the thermoplastic material from base resin to finished form product, manufacturing the base resin, compounding and fabricating. Methods of bonding the material to itself or other materials in production have also been developed. Cutting, drilling, and punching can be accomplished on ordinary wood or metal working equipment.

Tri-Phase Gunk NP 706

From The Curran Ordnance Chemical Laboratory comes a new gunk compound which is said to be highly effective for degreasing and scouring scale, rust and algae from radiator cores and engine blocks without harmful effect to the cooling system metal or hoses. The new product needs no neutralizer or immediate flushing as is required by acid and alkaline compositions formerly used. Also the use of this radiator gunk results in the unique and valuable property of inhibiting ferrous metals from rust and scale formation by virtue of its chromate content.

It is technically described as a triphase detergent of the organic type and possesses not only self-emulsifying properties but self-scouring action as well.

To use, a quart of the new gunk is simply added to the radiator. It is not necessary to remove or rinse the emulsified grease and colloidally suspended dirt (scale and rust particles which have been acted on by the digestive and peptizing action of gunk and reduced to ultramicroscopic particle size) until usual Spring or Fall draining period.

Cold Molding Plastic Powder NP 707

Gladite, a new plastic cold molding powder, is manufactured by Myler Plastics Corp. It requires no pre-heating, no pre-forming, no after-baking or finishing. When the part comes out of the press it is ready to use. The elimination of these processes cuts production time considerably and lowers unit cost substantially.

Parts can now cold-molded in colors; any color can be made or matched. The standard colors for Gladite are black, red, buff, light gray, yellow, light blue. and light green. All colors are fast and do not fade or bleed.

Insecticide Solvent NP 708

A new petroleum product for aerosol dispersion of DDT or other chemicals is made by Socony-Vacuum Oil Co., Inc.

Designated S/V Sovacide F, this product was developed especially for use in aerosol fogging, considered to be the most practical method of controlling insects over wide or relatively inaccessible areas.

STABILIZED ZIRCONIA

Unusually High Melting Point (2600° C)

Excellent Heat Shock Resistance

Possessing chemical stability, hardness and resistance to chemical attack, stabilized zirconia is even more exceptional because of its excellent resistance to thermal shock. These properties make stabilized zirconia crucibles ideally suited to the melting of precious metals such as platinum and high melting point super-alloys. They offer excellent possibilities in other applications. More detailed information may be secured from TAM research and engineering staffs or by writing direct.

COMPARATIVE CHARTS POINT UP ADVANTAGES

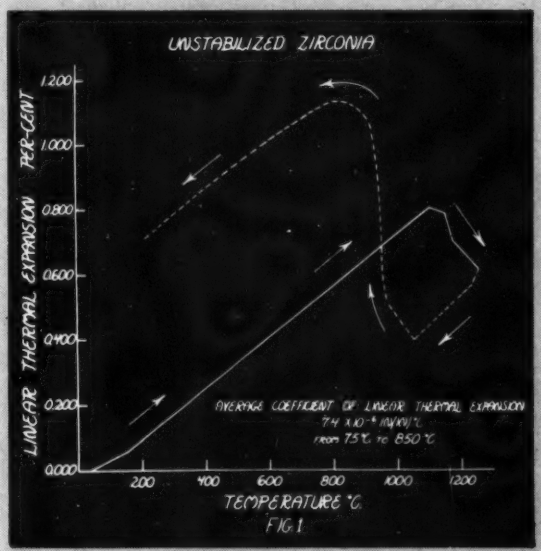


FIG. 1

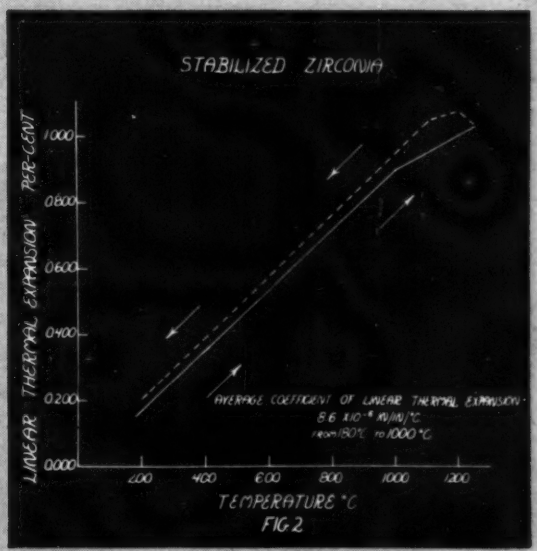
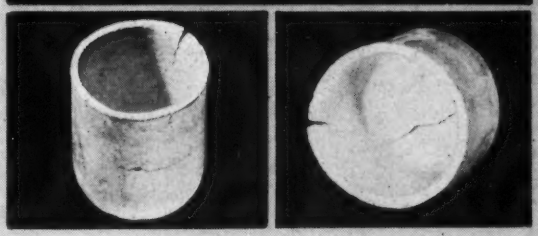
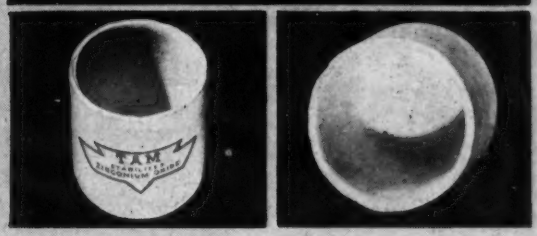


FIG. 2



Unstabilized crucible cracked badly after one cycle of air quenching from 15 minutes at 2800° F.



Crucible of stabilized zirconia did not fail after more than 20 such cycles.

TAM

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AMMONIA
is many things to many chemists

AMMONIA is a well-known and widely-used industrial chemical. It is the leading refrigerant and the main source of nitrogen for fertilizers. Petroleum refiners use Ammonia to neutralize acid in oil.

Ammonia is oxidized to make nitric acid or to furnish nitrogen oxides for producing sulphuric acid by the chamber process. Ammonia extracts certain metals from ores. It is a solvent and reaction medium in organic synthesis.

Ammonia is a nutrient for yeast and a nitriding agent for alloy steels. Cracked into its gases, Ammonia is a protective atmosphere for bright annealing, powder metallurgy and brazing. Dissociated Ammonia also supplies hydrogen for welding and for producing metal powders.

Ammonia is a processing agent in the manufacture of alkalis, rayon, dyes, pharmaceuticals, butadiene, and catalysts for cracking petroleum. Ammonia is used with chlorine to purify water.

Ammonia has literally hundreds of industrial uses. For information, contact Barrett, America's leading distributor of Ammonia.

Barrett Standard Anhydrous Ammonia is shipped in cylinders and tank cars.

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Aerosol fogs can be generated by ground equipment or from aircraft with such effectiveness that as little as one and a half pints of concentrated insecticide per acre is necessary.

"S/V Sovacide F" has been tested successfully and used under a variety of outdoor conditions in many parts of the United States and is available now in commercial quantities.

Fast Paint Stripper NP 709

A new development in cold dip paint strippers is being introduced to the finishing industry by the London Chemical Co. This product, identified as Kwikstrip, is a non-ionic stripper which can be used as a cold dip or applied by brushing to remove any organic finish from all metal surfaces including aluminum, zinc, magnesium or cadmium and also from wood surfaces as it is non-grain raising. It is non-inflammable, does not give off any obnoxious fumes and maintains its efficiency for an unusually long period as it contains no diluents and has incorporated in it an evaporation retardant.

It is a water soluble product and is readily rinsed off with water spray, leaving the metal surface clean and ready for refinishing. It does not require constant immersion to perform the stripping operation as the piece to be stripped can be merely dipped in Kwikstrip and removed at once, allowing the stripping action to be completed in a matter of seconds.

Polyvinyl Chloride—Nitrile Rubber Latex NP 710

Geon polyblend latex, a colloidal blend of Geon polyvinyl chloride and Hycar nitrile rubber which should prove particularly useful in the decorative coating and film fields, is now offered by B. F. Goodrich Chemical Co. It is supplied as a liquid containing 45-50% solids, with a specific gravity of 1.08. The mechanical stability of the latex is good.

Geon polyblend latex dries at room temperature to a tough, water-white film with excellent greaseproofing qualities. The film has a tear resistance of 1000 pounds per inch, a tensile strength of 2000 psi and an elongation of 350 per cent. A ten-minute fusion at 300° F. will raise the tensile strength to 3500-4000 psi and the elongation to 600-700 per cent, but will lower the tear strength by about 20 per cent. The film will heat seal at 280° F. Its low-temperature flexibility is good; it is still flexible at –50° F. It is tasteless and non-toxic. The slight odor present in the cast film disappears upon fusion.

A 2-mil film has a moisture vapor transmission of 6-8 grams per 100 sq.

Were FURFURAL solely a ..... **SELECTIVE SOLVENT** It would warrant your investigation

Were FURFURAL solely a ..... **DISPERSANT** It would warrant your investigation

Were FURFURAL solely a ..... **RESIN INGREDIENT** It would warrant your investigation

Were FURFURAL solely a ..... **CHEMICAL INTERMEDIATE** It would warrant your investigation

But when furfural has all these uses and is at the same time the lowest priced pure aldehyde available today and is readily available in tank car quantities—why delay investigating its possibilities.

QO CHEMICALS

PHYSICAL CONSTANTS AND SOLUBILITY OF FURFURAL

Molecular weight	96.08
Freezing point, °C.	−36.5
Boiling point, °C.	161.7
Specific gravity (20/4°C)	1.1598
Flash point (open cup), °C.	56.8
Refractive index (20°C)	1.5261
Surface tension at 20°C (dynes/cm)	49
Viscosity (centipoises)	
38°C.	1.35
54°C.	1.09

Miscible with most common alcohols (for example methyl, ethyl, isobutyl, and n-octyl alcohols), esters (such as ethyl, butyl and amyl acetates), glycol ethers, acetone, toluene, linseed oil and chinawood oil. Soluble in water at 20°C to extent of 8.3%. Partly miscible to immiscible with glycerine and paraffinic hydrocarbons.

SHIPPING INFORMATION

Standard Containers:	9, 45, 90, and 520 lb. drums.
Carload of 80 drums	41,600 lbs.
Tank car 8,000 gal.	78,000 lbs.
Tank car 10,000 gal.	98,000 lbs.

Drums non-returnable

The first step in evaluating furfural for your needs is to send for a copy of Bulletin 204—Current Uses of Furfural. Just write "204" on your company letterhead and sign your name.

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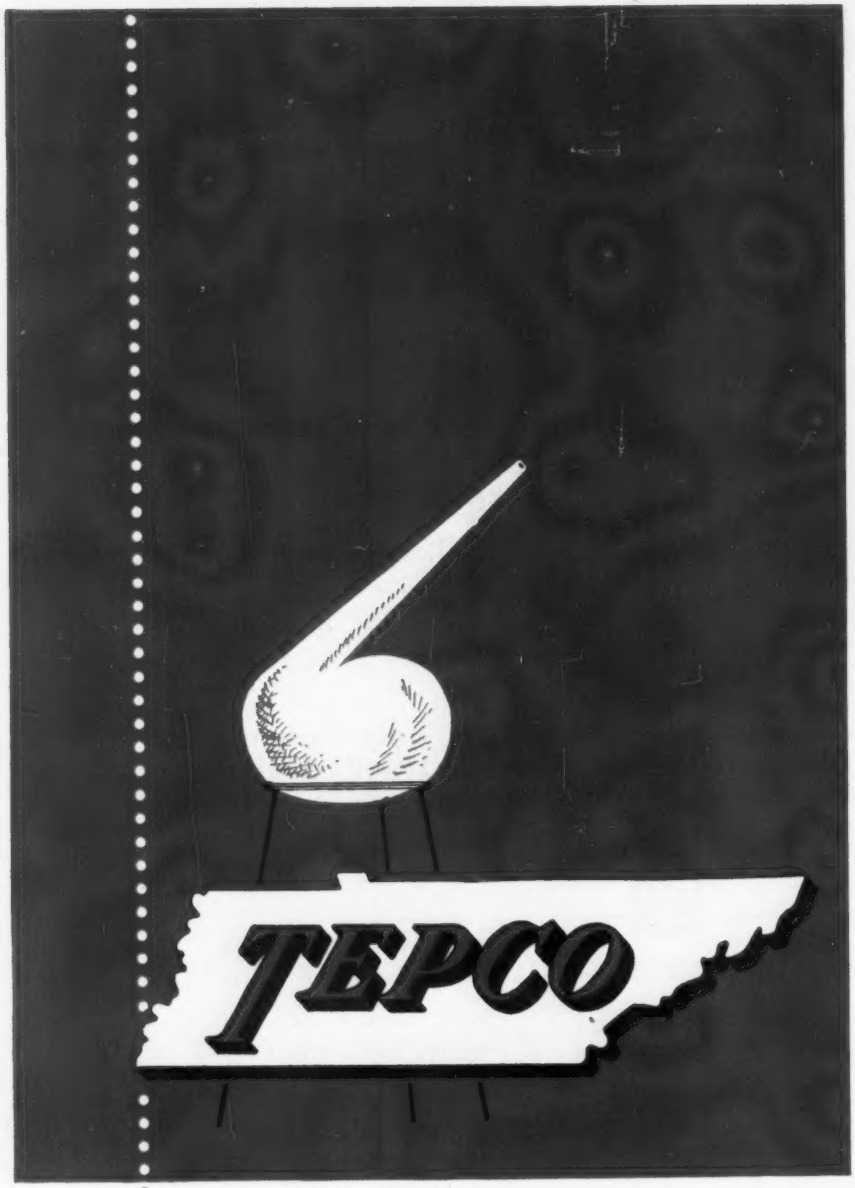

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inch in 24 hours. While too great for cheese, this MVT is ideal for olemargarine and meats where exceptionally low MVT's are objectionable. It should prove excellent for packing frozen foods.

A dielectric strength of about 800 volts/mil open up the possibilities for the material in electrical applications.

A paper coated with the latex will show a 10 per cent greater Mullen burst pressure and a tear resistance improved 100 per cent. When tested face to face, the coating will not block below 160° F. and at normal temperatures the surface is completely tack-free.

In addition to purely decorative coatings, a few other possible uses for latex coated paper and boxboard are packaging for bread, doughnuts and other greasy pastries, gum and candy wrappings, cigarette packages and cardboard milk containers.

Acid, Alkali Proof Duct Lining NP 711

An acid and alkali proof lining material for fume-carrying ducts is now being offered for general use by the Ceilcote Co. The new product, known as Ceilcote Spray Grade, is proof against acids and alkalies and has a maximum temperature resistance of 300° F. in bonds to either wood or metal. Application is by special spray equipment which builds a lining up to ⅛" thickness, affording expansion and absorption and eliminating cracking from vibration. It is offered on an installed basis; or for those desiring to make their own installation, special spraying equipment is available on a rental basis.

Ion-Exchange Bead-Type Resin NP 712

A new high-capacity synthetic resin Amberlite IR-105 cation exchanger, is offered in bead form by The Resinous Products & Chemical Co.

Key advantages of the new resin include: (1) a smooth spherical shape, (2) freedom from odor, taste and color-throw, (3) highly uniform particle size, (4) higher density, (5) rugged physical properties, and (6) high exchange capacity obtained at efficient regeneration levels. Its unusual chemical stability and high capacity are of special interest in applications such as the softening, dealkalization, and deionization of water.

The resin derives its activity from sulfonic acid groups, and may be employed either in the sodium or hydrogen cycle.

The resin is shipped in the sodium form (in a moist, completely swollen condition) but can easily be converted to the hydrogen derivative by treatment with mineral acids.

The specific physical characteristics of Amberlite IR-105 are: a density of about 47 pounds as shipped (corresponding to

For exacting chemical control, from raw materials to finished products, industrial laboratories the nation over depend on B&A Reagents for precision analyses.

Control chemists—guarding their companies' products against impurities and imperfections—have found through *experience* that the Baker & Adamson label is their best protection against uncertainty and inaccuracy. They know B&A Reagents can always be counted on to adhere to the exacting A. C. S. specifications shown . . . without deviation, to the last decimal place, lot after lot, product after product.

This constant compliance with the purity standards established by the chemical profession itself sets B&A Reagents apart. It gives them the extra margin of quality that so many careful chemists recognize. No wonder they say: "There *is* a difference in reagents. . . . That's why I specify B&A for my work."

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3 NEW AMBERLITES that will REVOLUTIONIZE your ideas on ION EXCHANGE

THE RESINOUS PRODUCTS

WASHINGTON SQUARE

A few short weeks ago we announced the addition of the new AMBERLITE IR-105 cation exchanger to our already established and well-known line of AMBERLITE synthetic resin exchangers. Now we present, after years of development, 3 *more* new ion exchange resins with exciting possibilities. New operating efficiencies and economies in water conditioning, including one-step silica removal; purification of chemical wastes; concentration and purification of drugs and food products; removal of salts at controlled pH values—these are but an indication of the radically new approaches to ion exchange processes made possible by the new AMBERLITE synthetic resin ion exchangers.

AMBERLITE IR-120 Cation Exchanger

Nuclear sulfonic acid type cation exchange resin in bead form.

1. Extremely high capacity.
2. Outstanding chemical stability. Resistance to strong alkalies, acids, and mild oxidizing reagents.
3. Good physical properties—high density.
4. Unifunctional.

AMBERLITE IRA-400 Anion Exchanger

Strongly basic synthetic resin anion exchanger in granular form.

1. Completely splits neutral salts. Functions in anion exchange reaction as sulfonic acid types operate in cation exchange.
2. First exchanger to make reverse deionization possible, *i.e.*—anions removed prior to cation exchange operation in place of ordinary method of cation exchange followed by anion removal.
3. High exchange rate, good physical and chemical properties.

AMBERLITE IRC-50 Cation Exchanger

Carboxylic acid type synthetic resin cation exchanger in white bead form.

1. Exerts little effect on neutral salts such as NaCl, Na_2SO_4, KBr, etc.
2. Easily converted to hydrogen form (regeneration efficiency almost 100%).
3. Easily "buffered" to any desired ratio of acid to salt form.
4. Effectively splits salts of weak acids.
5. Extremely high capacity.
6. Desirable for the treatment of acid-sensitive solutions since it generates only low acid concentrations when functioning in hydrogen form.
7. High exhaustion rates in sodium form.

★

Technical information on the 3 new AMBERLITES is ready! Write The Resinous Products & Chemical Co., Dept. CI-1A, Washington Square, Philadelphia 5, Pa., and you will receive full data promptly.

AMBERLITE is a trade-mark, Reg. U. S. Pat. Off.

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1 cubic foot of space in place backwashed and drained); a moisture content of 40 to 50%; a wet screen grading of 16 to 50 mesh; an effective particle size of 0.4 to 0.6 millimeters; a maximum uniformity coefficient of 1.7; and voids of approximately 45%. High physical stability insures against attrition losses.

Cold Paint Stripper NP 713

The formulation of a new and greatly improved cold paint stripper has been announced by the Allied Finishing Specialties Co. The product will be marketed under the "Electro" label and is to be sold in bulk only to the industrial trade.

The new product requires no heat and is not flammable. It removes paints, lacquers, enamels, synthetics, varnishes and wrinkles almost instantly and requires no neutralizing action other than a pressure water flushing or wiping well with a rag. Refinishing can then proceed immediately, if desired.

The product is non-injurious when used as directed and it will not affect aluminum, copper, brass, magnesium, zinc, steel, cast iron or their alloys in the time required for removal of the paint film. Due to a new principle in the formula, this film literally "pops off" in a matter of moments, saving much time, permitting immediate refinishing and greatly speeding production.

Electro Cold Stripper is primarily intended for dipping but may be applied by either brush or spray. It works well on either vertical or horizontal surfaces and has been found especially effective on hard-to-remove baked-type finishes.

Cation Exchanger NP 714

The Chemical Process Co. has recently succeded in developing a weak acid-type cation exchanger which is called the Duolite Cation Selector CS-100. In the presence of a buffering anion which prevents the pH from dropping, this material will selectively and completely remove divalent ions over the monovalent ones. Even where a pH drop occurs, the divalent ions are removed selectively but some leakage does occur, depending upon the extent of the pH drop.

One indicated use of this material is its employment ahead of a standard D.I. unit to remove calcium salts and thus eliminate to a certain extent the calcium load upon the sulfonic acid-type cation exchanger since the latter experiences difficulty, when sulfuric acid regenerant is being used, in handling a heavy calcium load as a result of low acid efficiency and a calcium sulfaate blockage. The Duolite Cation Selector used ahead of D.I. unit can be regenerated with the waste acid from the latter. The material also shows some promise in the fractionating of cations and perhaps amino acids.

HEYDEN

CHLORINATED BENZENES

MONOCHLOROBENZENE

ORTHODICHLORO-BENZENE

PARADICHLORO-BENZENE

TRICHLOROBENZENE

Heyden chlorinated benzenes (benzols) are widely used in organic syntheses and have extensive applications in the manufacture of solvents, insecticides, textile chemicals, medicinals, weed killers, polishes, explosives, soil and sewage disinfectants, protective coatings, and many other industrial and commercial uses.

AVAILABILITY

Heyden Chlorinated Benzenes are shipped in seller's cars from our plant at Memphis, Tennessee: Tank cars, approx. 74,000 lb.; drums, approx. 475 lb.

MONOCHLOROBENZENE is one of the most extensively used Heyden chlorinated benzenes (benzols). It is important as an organic solvent and as an intermediate in formulation of dyes, herbicides, pharmaceuticals, insect exterminators, etc.

PROPERTIES

A clear, almost colorless liquid practically insoluble in water. Freely miscible with most organic liquids.

Boiling range—Within 1°C. including	132.1°C. at 760 mm.
Freezing Point	−45°C.
Specific Gravity at 25/25°C.	1.105
Flash Point	
Closed Cup	29°C.
Open Cup	90°F.
Copper corrosion	negative

PUT THE PLUS IN YOUR PROCESS!

- ...Constant source of supply.
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- ...Exacting specifications...assured quality.
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NEW EQUIPMENT

Teflon Packing QB 541

Use of Teflon, polytetrafluorethylene, is an important improvement in packing valves, centrifugal and rotary shafts, reciprocating rods and other points. It is available from the Crane Packing Co. The new Crane products will be listed as the Chemlon line. Teflon is not affected by *any* solvent acid mixtures, acids, or caustic solutions at temperatures to 690° F. Excessive wear of reciprocating rods, shafts, and valve stems are eliminated by the non-adhesive characteristics of Chemlon.

Chemlon is available in round cross-section braided spool-form ⅛" to 1". Two types of braided material are furnished, one untreated and one treated with a lubricant unaffected by acids or caustics to 300° F.

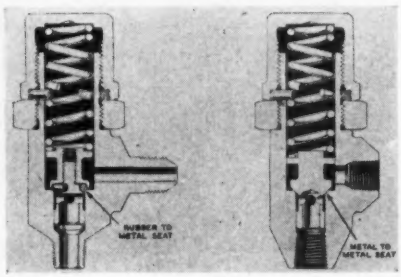
For installations where endless rings can be installed, Crane has perfected rings of Teflon, (not merely machined bushings) that possess the required packing resilence.

In this type of ring, two forms are available: Style 772, which contains no lubricant, and Style 776 which is impregnated with graphite throughout the fibrous structure.

Relief Valves QB 542

A new series of hydraulic and pneumatic relief valves has been introduced by The Parker Appliance Co. They are available in five pressure ranges: 0-15, 10-50, 40-125, 115-250 and 235-450 psi, and can be easily set to any operating pressure in a particular pressure range.

The shut-off piston is guided for quick unloading and smooth, silent operation. For hydraulic application, the piston makes a metal-to-metal seat with the body. An O-ring rubber-to-metal seat is provided for a positive seal where gases are used. For added protection, the piston is formed to enclose all of the synthetic rubber except that portion which actually seats.



The body and cap are available in aluminum or brass, while the springs and metal-seat pistons are of stainless steel. The rubber seat piston is of brass.

The full series of pressure ranges are available in each of six basic sizes from ¼" to ¾". Sizes 1" and larger, as well as pressure settings to 1000 psi, are obtainable on special order.

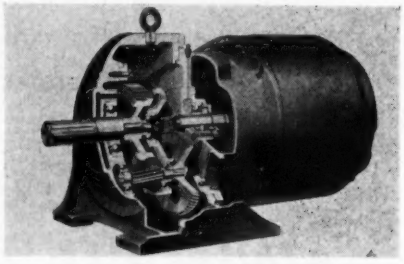
Bulb-Type Temperature Controller QB 543

The new indicating temperature controller of the United Electric Controls Co. applies the highly sensitive response motion of a liquid filled bulb and bellows assembly to a snap-acting switch. With this design, construction can be unusually rugged without detracting from acute sensitivity. In addition, any of the numerous standard remote bulb assemblies may be used.

By turning a thumb screw, the upper indicating pointer may be set at any desired temperature cut-off point. The standard model of the new controller is fitted with a copper bulb assembly. However, assemblies in stainless and mild steel are available. Two standard ranges +50°F to +350°F and +50°F to +600°F are offered, or special ranges may be had between the limits of −120°F to +600°F. Standard differentials available are from ½°F in circulating liquid to 2°F in air. Switch ratings of 10 amp 125 V AC and 5 amp 250 V AC are offered with other electric load rating available.

Gearmotor QB 544

A new gearmotor of unusually compact design has been developed and will be produced jointly by The Reliance Electric & Engineering Company, Cleveland, and the Philadelphia Gear Works, Inc.



Probe-Type Level Control QB 545

Photoswitch Type 10CB1 introduces completely maintenance-free level control to the chemical processing industry, according to the manufacturer. This control consists of an electric relay operating from a probe circuit through a transformer and a rectifier. Only stainless steel probe rods are located in the liquid.

Type 10CB1 will control the level of practically all electrically conductive liquids. The probe circuit may be set at several different sensitivities. Thus it will discriminate between a liquid and its foam.

Type 10CB1 is stated to be the only floatless level control containing no vacuum tubes and operating with low

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CHEMICAL INDUSTRIES, 309 W. Jackson Blvd., Chicago 6, Ill. (7-8)

Please send me more detailed information on the following new equipment:

QB541	QB545	QB549	QB553	QB557	QB561
QB542	QB546	QB550	QB554	QB558	QB562
QB543	QB547	QB551	QB555	QB559	QB563
QB544	QB548	QB552	QB556	QB560	QB564

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THAT NEVER CLOSES

A PACKAGE

THIRSTY MULTIWALLS

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How to get kink-free performance from sewing machines, and how to keep multiwall paper shipping sacks from getting thirsty are but two of the many questions Bemis Multiwall Specialists answer regularly.

Call the Bemis office nearest you when you want to discuss your packaging operation with a multiwall specialist. Use this Bemis service without obligation.

Six Bemis Multiwall Plants make millions of these shipping sacks . . . and the Bemis high standard of quality is maintained in both materials and construction.

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Smilin' Tex says:

"IT AIN'T BRAGGIN' IF YOU CAN PROVE IT"

In Texas your taxes are as low as — or lower than — any place in the U. S. A.

They say there are two things no man can escape — death and taxes. That's true. It is also true that in Texas you pay the minimum in the way of taxes, for the Lone Star State has *no sales tax, no State income tax,* but on its statutes there is *a community property law.*

To the friendly tax laws (or lack of unfriendly ones) can be added many other reasons why you should build your chemical plant on the Texas Gulf Coast:

Here you will find a superabundance of sulphur, salt and hydrocarbons — the big three basic materials upon which the chemical industry feeds. Also at hand are raw resources in variety and quantity unmatched elsewhere.

Plus: rail, water, highway and air transportation to all markets; economical, *natural* gas for fuel; cooperative labor; an abundance of pure water; and a moderate climate inviting to both work and play.

Send for a Survey of the Texas Coast Country. On request, we will prepare for your company a carefully engineered and confidential survey of the Texas Coast Country individualized to fit your particular problem. No cost, no obligation. Address Research Department, Houston Pipe Line Company, Houston, Texas.

HOUSTON PIPE LINE CO.

Subsidiary of Houston Oil Company of Texas

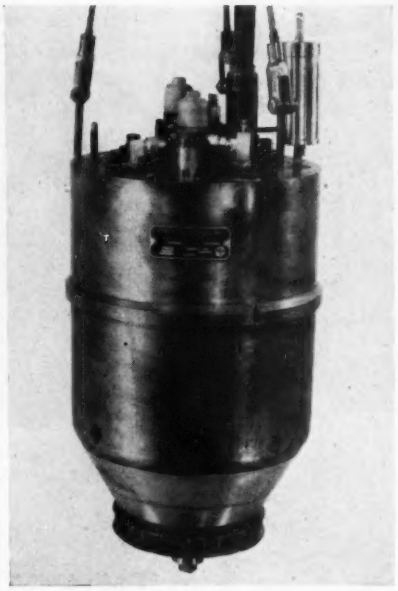
GEO. A. HILL, JR., President

Wholesalers of Natural GAS

voltage in the probe circuit. The liquid to be controlled makes or breaks contact with the probe and transmits to the control a minute electrical current at low voltage. This current operates a relay to actuate signals, valves, or pumps.

High Speed Atomizer QB 546

Bowen Engineering, Inc. has developed a new high speed spray machine to handle up to 6 tons of wet material per hour. The units, furnished with Bowen engineered spray drying installations,



have a variable speed range up to 20,000 rpm and power ratings up to 60 hp.

The feed pipe and the atomizing wheel are stainless steel. Shaft assemblies are dynamically balanced, oiling system is gravity feed and oil is circulated by positive suction system. Replacement parts are immediately available from stock.

Explosion-Proof Lighting Fixture QB 547

An explosion-proof lighting fixture, designed specifically for use during manufacturing operations in the chemical, paint, petroleum, and related industries is now in commercial production by Safe Lighting, Inc. According to the producer, it is the only fixture ever rated for use in Class 1, Groups A and B hazardous locations by the Underwriters' Laboratories, Inc.

The unit was granted its Class 1, Group A rating following extensive tests by the Underwriters in the presence of flammable and explosive atmospheres containing acetylene, and its Class 1, Group B rating after tests in atmospherees containing hydrogen or gases and vapors of equivalent hazard, such as manufactured gas.

The fixture, threaded for rigid conduit connection, is designed for operation with air pressure of about 19 psi in the lamp compartment to prevent the entrance of surrounding hazardous atmospheres. If, for any reason, the pressure drops to about three psi, the incandescent lamp automatically switches off.

Two sizes are available, one using a lamp of 75 or 100 watts and the other a lamp of 10 or 200 watts. The 200 watt size produces on the working plane illumination in excess of that obtained from the 300 watt size explosion-resistant fixtures. The fixture has been tested with respect to vibration and safe maximum external temperatures.

Oscillating-Trough Conveyor QB 548

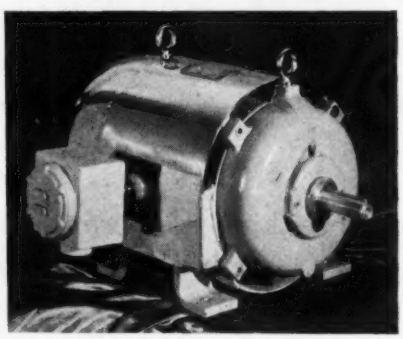
The new "PA" oscillator of the Link-Belt Co. is a positive-action, roller bearing, eccentric type oscillating trough feeder-conveyor. It is available in standard trough widths of 12-48" and in single trough lengths of up to 100'.

Besides conveying material, the new "PA" oscillator pan may also serve as a cooler, dryer or conditioning unit when jacketed, louvered or otherwise constructed for the service intended. Differing from the construction of previous oscillating-trough conveyors, the "PA" oscillator trough is supported on a series of short arms and adjustable torsion bars, having the effect of reactor springs.

Corrosion Resisting Electric Motor QB 549

A corrosion-resisting A-C motor for general application in the chemical industry has been developed by The Reliance Electric & Engineering Co. and will be offered in frame sizes 203 through 326.

Built to standards set by the Underwriters Laboratories for operation in

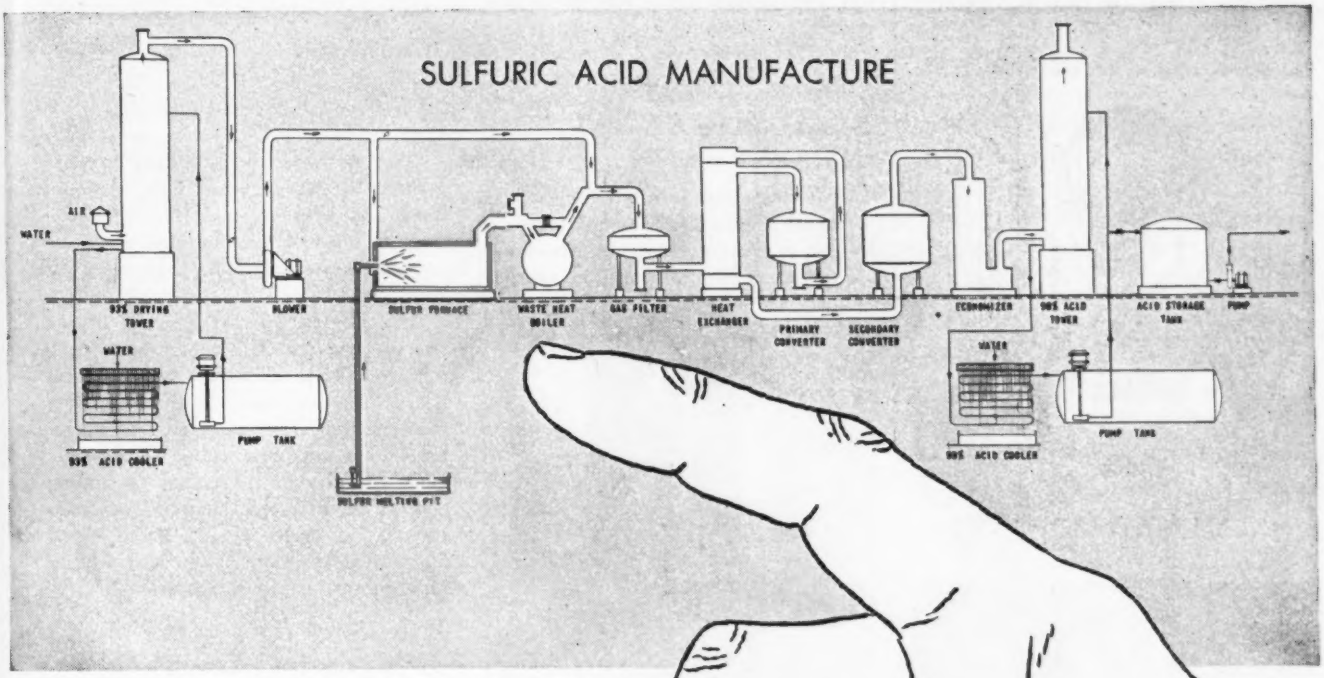


Class I-Group D (for locations where hazardous conditions are present), the new motor has also been made explosion proof.

By the addition of a multi-conductor cable, rubber hose, and suitable packing glands, the motor fully meets the specifications of the Bureau of Mines for use on "permissible" equipment.

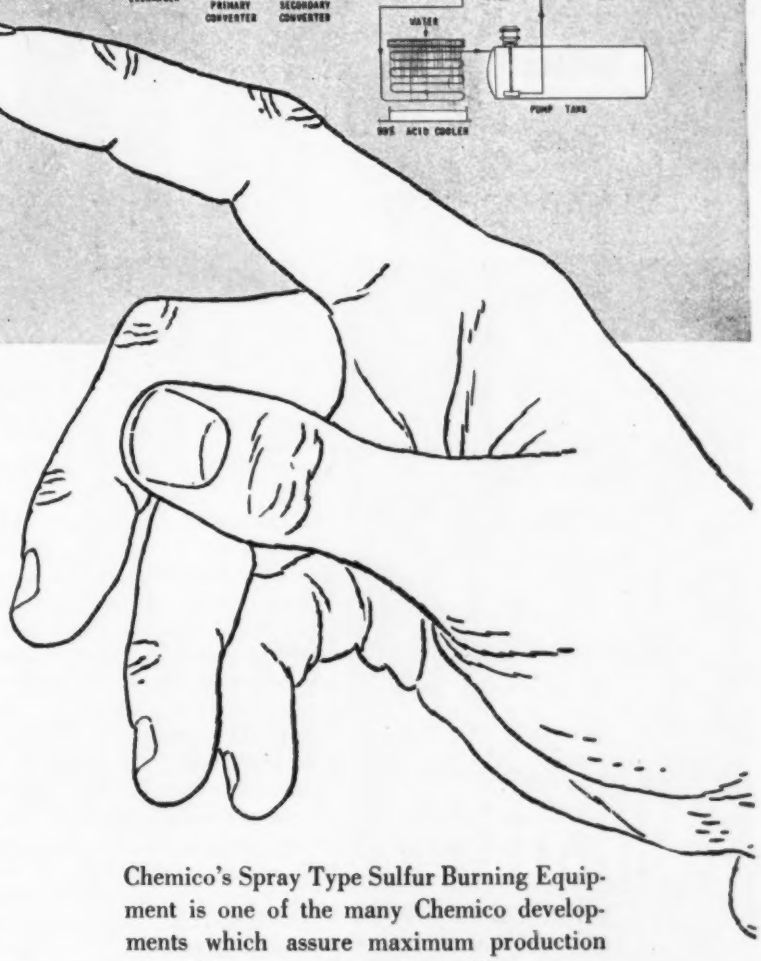
Monel metal has replaced steel in the outer cover of the new motor, in the fan cover, and in the construction of the lead outlet where the usual steel channel has been replaced as a lead enclosure with a

Maximum production of acid from every pound of sulfur...in a CHEMICO CONTACT ACID PLANT



Spray Type Sulfur Burning Equipment is an exclusive feature of Chemico contact acid plants . . . a feature which permits:

- ***Complete combustion — no sublimation***
- ***Uniform SO_2 gas strength***
- ***Perfect temperature control for converter operation***
- ***Elimination of moisture and impurities by premelting the sulfur***
- ***Minimum formation of SO_3***
- ***Quick starting and stopping of operation***
- ***Low upkeep***



Chemico's Spray Type Sulfur Burning Equipment is one of the many Chemico developments which assure maximum production of acid from every pound of sulfur.

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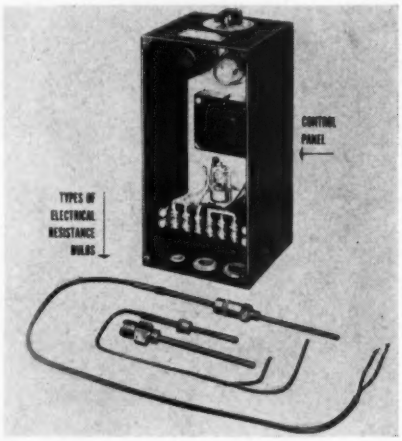
monel pipe nipple going directly into the inner enclosing shell.

Cast bronze replaces cast aluminum in the fan, and extra grease and bearing protection has been given the new motor by the addition of bronze shaft collars.

Brass has replaced steel in the grease pipes and in the screws which hold on the fan cover. Bolts holding the outer fan, being in a partially protected location and readily replaceable, have been made of cadmium-plated steel. Fine-grained cast iron replaces pressed steel in the construction of the conduit box.

Temperature Controller QB 550

A new temperature controller has been developed by the Instrument Division of Thomas A. Edison, Inc. The device uses a single electronic tube with an electrical



resistance type bulb for thermal pick-up and is of the on-off type.

The use of the resistance bulb permits location of the sensing element at a point remote from the control panel and eliminates the necessity of thermal compensation. This device, which is non-indicating, may be used to control temperatures to close tolerances in solids, gases, or liquids. Units are available to cover the temperature range from —100°F to 1200°F and are adjustable within a range of several hundred degrees.

Supply voltage may be 115 or 230 volts 50-60 cycle AC. Load capacity is 30 amperes at 115 volts, 20 amperes at 230 volts. Accuracy of the controller is independent of usual voltage variation. Normal response time is under three seconds, dut to the patented bulb construction.

Liquid Level Gage QB 551

A new liquid level gage capable of withstanding pressures up to 10,000 psi has been developed by the Jerguson Gage & Valve Co.

In the new Jerguson high pressure gage the chamber and covers are machined from bar steel stock, and the covers have a series of one-half inch ports through which the liquid level, color or density is viewed. The glass is 11/16" thick tempered Pyrex, and O-Ring gaskets confine the pressure on the glass to the area of half-inch diameter circles.

The gage is built in standard lengths up to approximately six feet. It is also available in stainless steel or other special metals to resist corrosive conditions.

Stainless Steel Aneroid Manometer QB 552

The Taylor Instrument Companies have added a 316 stainless steel unit to their regular line of aneroid manometers.

The housing and all internal parts in contact with corrosive mediums are of Type 316 stainless steel. Because corrosive fluids can be introduced directly into the manometer, no sealing fluids or purges are necessary.

As in other Taylor aneroid mercuryless manometers, the balancing agent is a torque tube to eliminate any need for liquid. The elimination of mercury prevents product contamination and maintenance is cut to a minimum because there is no mercury to replace; no stuffing box, no internal parts to wear out. It is available in ranges of 20, 50, 100 and 200 inches of water differential with a body pressure rating of 300 psi.

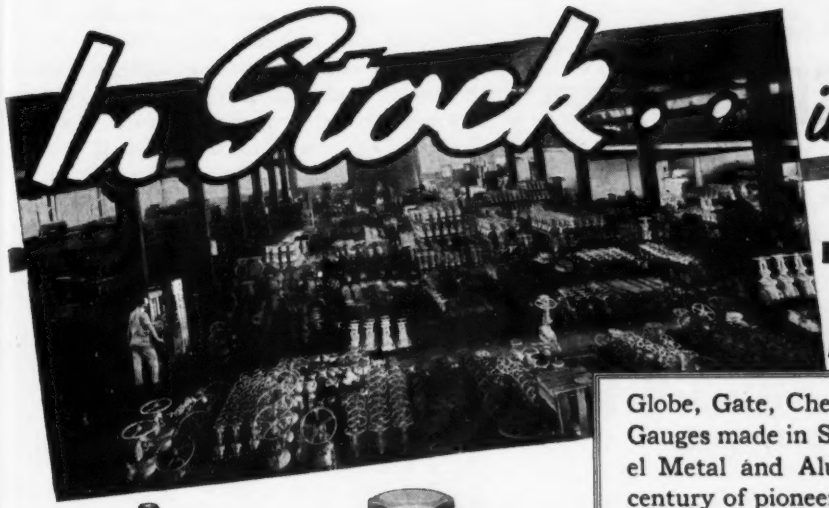
Fractional HP Air Compressors QB 553

Two new portable fractional-horsepower air compressors are available from American Brake Shoe Co.'s Kellogg Div. for production of 100% oil-free air. Both compressors are readily adjustable for different pressures.

Model 17-C (shown with handle) delivers 4.4 cfm at 40 psi powered with a ½ hp

electric motor. New "lubricated for life" sealed ball bearings eliminate the necessity of oiling and the danger of burned-out bearings. The entire mechanism is encased in welded steel frames for greater stability—a new feature of construction in diaphragm type compressors. The model has twin air cleaners which are quickly accessible by loosening only two cover screws.

Model 8-C delivers 2.2 cfm at 25 psi with a ¼ hp. electric motor. It is equipped with a single air cleaner with no cylinders, piston or rings to wear out. A force feed oil system assures positive lu-



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Globe, Gate, Check and "Y" Valves and Liquid Level Gauges made in Stainless Alloys, Nickel, Inconel, Monel Metal and Aluminum—the result of a quarter of a century of pioneering in the field of Special Designs and Special Alloys for Corrosion Resistance.

Also a complete line of Bronze, Iron, and Cast Steel Valves in stock for immediate delivery.

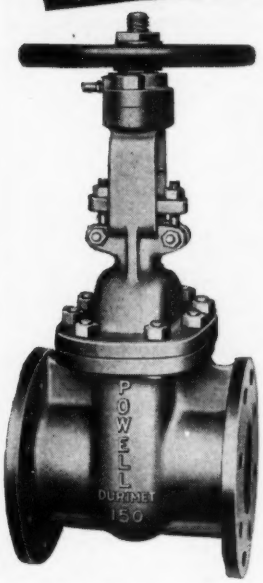

Fig. 2453-G—Durimet "20" O. S. & Y. Gate Valve.

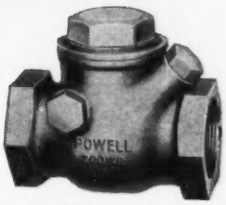

Fig. 1843—Monel Metal* Swing Check Valve. Screwed-in cap.

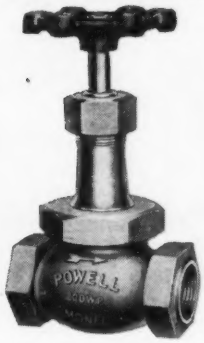

Fig. 1834—Monel Metal* Globe Valve with union bonnet.

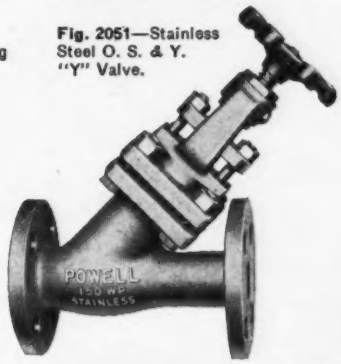

Fig. 2051—Stainless Steel O. S. & Y. "Y" Valve.

Fig. 1830-IN—Inconel* Gate Valve. Screwed-in bonnet, inside screw rising stem.

Fig. 1886—Stainless Steel Liquid Level Gauge with screwed ends. Offset pattern.

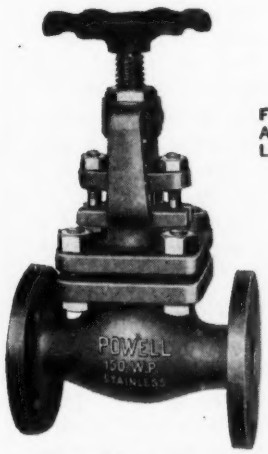

Fig. 1969—Stainless Steel O. S. & Y. Gate Valve.

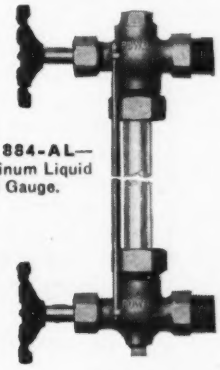

Fig. 884-AL—Aluminum Liquid Level Gauge.

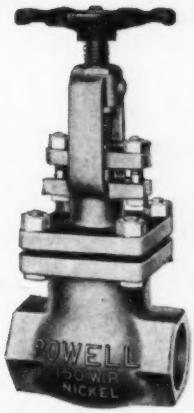

Fig. 1968-NI—Nickel O. S. & Y. Gate Valve.

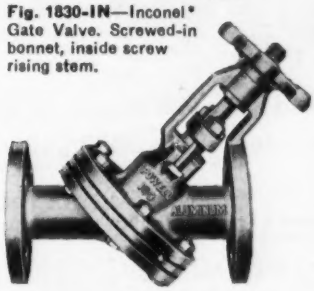

Fig. 1097-AL—Aluminum O. S. & Y. "Y" Valve. Separable Body, Reversible Seat.

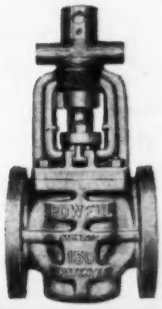

Fig. 1405—Stainless Steel Mechanical Lift Plug Cock.

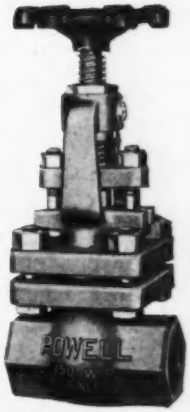

Fig. 1978—Stainless Steel O. S. & Y. Globe Valve.

If you do not have a copy of the Powell Alloy Valve Catalog No. 242—"Powell Valves for Corrosion Resistance", write for one.

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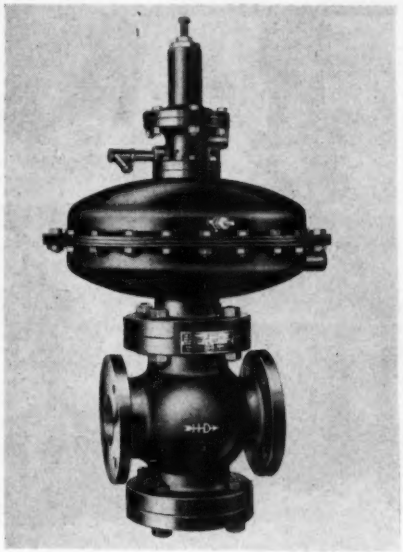
brication. The unit is mounted on a sturdy steel base with rubber feet.

Two other models are furnished for use on continuous flow applications only, and do not have the automatic bleed. They are suitable for flows of 0.02 scfm or more. These regulators—an absolute pressure model and a vacuum pressure model, have standard regulated pressure ranges of approximately 0 to 20 psi.

Pressure Loaded Gas Regulator QB 554

The new 5000 Series pressure loaded supersentitive gas regulator of the Hammel-Dahl Co. will control pressure within a fraction of an inch water column—even with large variations in flow. They may be used on either reducing or back



pressure service for any control pressure up to 100 psi. Fluid pressure from the outlet side of the valve is applied to the under side of a large area diaphragm. Loarding pressure from an integral pilot is applied to the upper side of the diaphragm. The opening of the fixed orifice determines the sensitivity of control, providing almost frictionless operation. The valve body may be either cast iron or steel with a steel diaphragm case and a maximum working pressure of 250 psi.

Vacuum Controllers QB 555

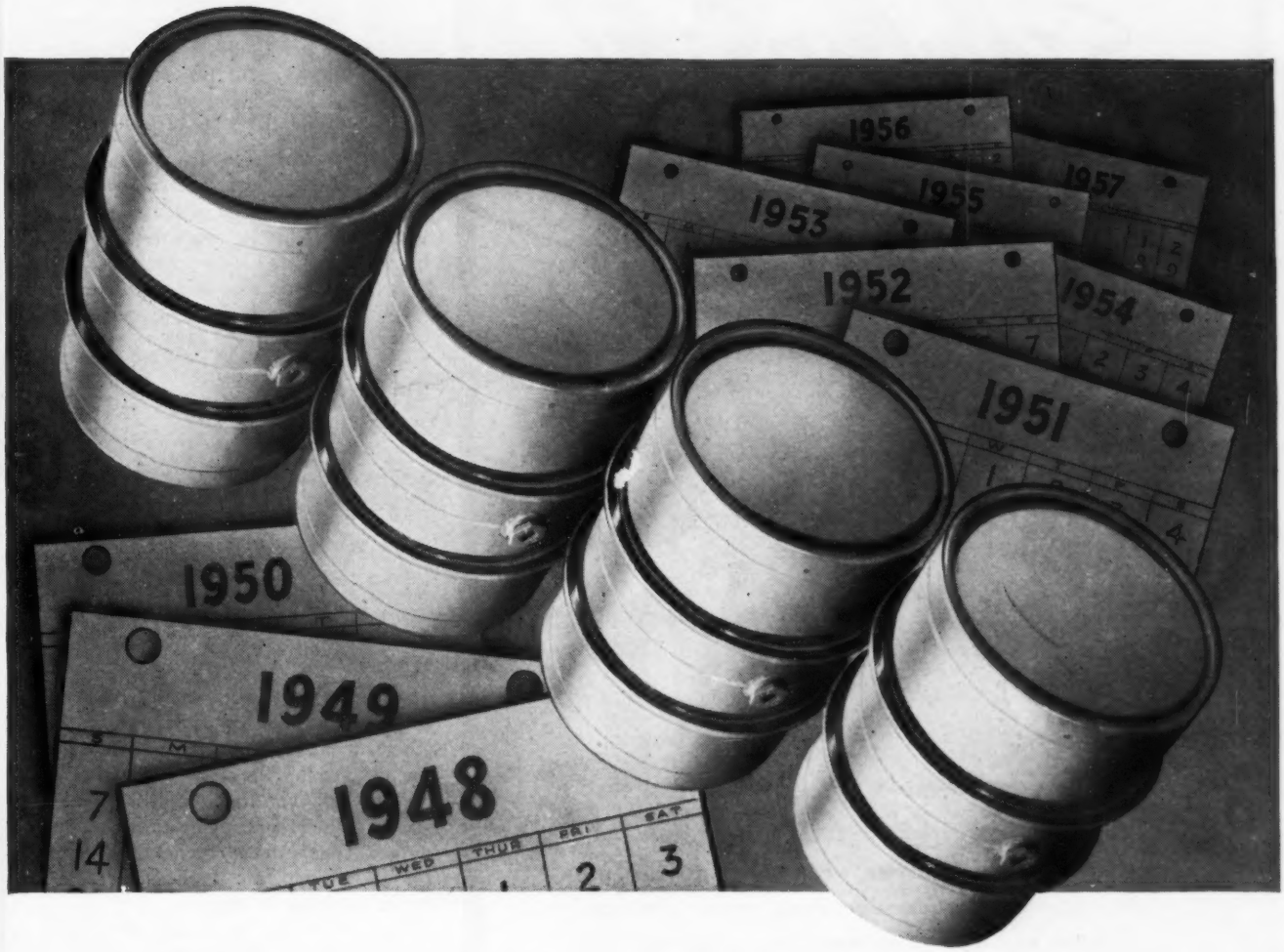
A new line of Nullmatic pressure regulators for sub-atmospheric applications has been made available from Moore Products Co. It inclures models with barometric compensation for regulating at absolute values.

These instruments are designed to hold set values constant, regardless of changes in flow as well as variations in the supply pressure. Nullmatic regulators may better be described as pressure controllers, since they use the pneumatic "null' balance system in which the main valve is operated by a pilot nozzle.

Two models have an automatic bleed

LONGER LIFE

. . . to widen your profit margin



Extra trips are built right into Hackney 2-piece Acid Drums

This long life is partially traceable to seamless cold-drawn construction. Then there are no longitudinal or chime seams—only one circumferential butt weld located between and protected by two I-bar rolling hoops. After fabrication, a special heat-treating process increases resistance to corrosion. Sturdy, easy-to-clean—there is no more economical container. *Write for full details.*

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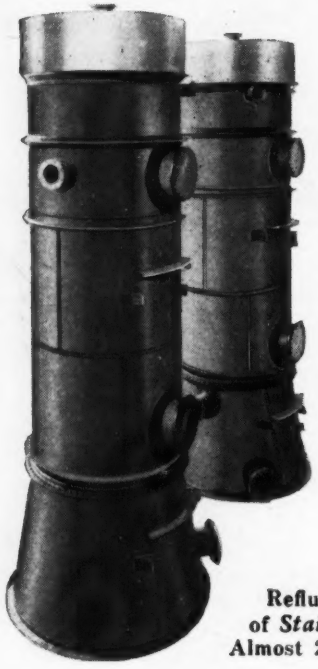

Reflux Towers of *Stainless Steel* Almost 25 Feet High

Stainless Steel **is the answer when colors are not reproducing true in successive runs, when products suffer from metallic contamination, or if you are using extremely sensitive solutions or acids. For dyestuffs, chemicals, water and steam . . .** ***Stainless Steel*** **reduces maintenance and repair costs, expenses of frequent changes and adjustments, resists corrosion and will soon repay initial costs.**

Truitt will fabricate tanks of any size and capacity for acids, caustics, dyes and special solutions. Let ***Stainless Steel*** **solve your problem. Refer your requirements to us . . . our engineering services are available to you without cost.**

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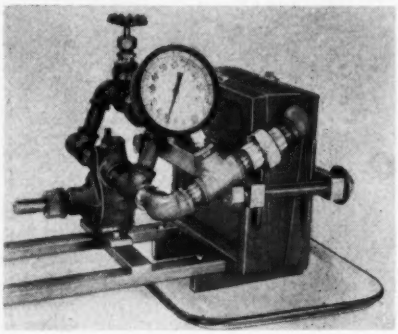
for use on dead-end service as well as on flow and reverse-flow service. The model illustrated, suitable for regulating absolute pressures, has an evacuated chamber. The other model is not compensated for barometric pressures. Regulated pressure range of these instruments is 1 to 20 psi when used on dead-end service, or approximately 0 to 20 psi when used on continuous flow service of 0.02 scfm or more.

• QB 556 A new *test press*, designed for testing, filtering, and clarifying on small batch work in laboratories and for light production jobs is available from the Chemequip Co.

According to the manufacturer, the Chemequip test press has several advan-



tages. First, it is easily set up. The unit is designed to use its own pump or another pump can be put on the line. Only one filter cloth is necessary and no holes need be cut. The frame itself is 8 inches square with 98 square inches of filtering surface. The average frame thickness is 1½ inches and the frame has an included angle of 10 degrees.

The press can be easily dismantled and cleaned. It can be taken completely apart in only a few minutes. Also, since it is a bench model and portable, it can be stored easily when not in use.

The rate of filtering different materials can be tested at various pressures. Liquid is fed through the pump with a by-pass to control pressure, into the center of the frame. A wedge-shaped cake is formed, which in turn provides means for testing the drying properties of various cake thicknesses.

• QB 557 A new type of *counting and weighing scales* is now being produced by the National Scale Co. The scales enable one man to handle bulky or heavy material by rolling the scale over objects to be weighed or counted. They also eliminate time-consuming transportation of goods to central scale installations.

The new scales are mounted on wheels and 4′ legs. The scale is rolled over the items to be weighed and standard "grabs" are fastened on. A hydraulic-lift swings the load clear of the floor, and direct weight or count readings are taken from the indicating head.

Models now in production have a

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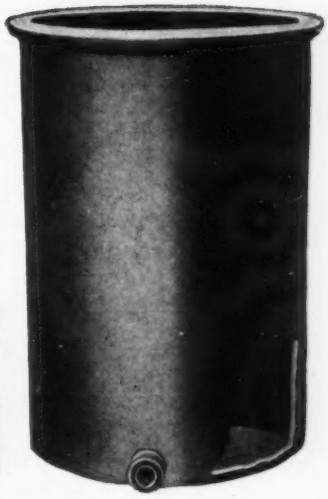

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Nitric Acid · or any other strong corrosive agent

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Controlling the temperature of the quench means a uniform product...fewer rejections. Ample cooling capacity independent of water supply eliminates shut-downs because of hot oil. The heat is transferred from the oil to air by the evaporation of a water spray. Only the water evaporated is used and 95% of the water cost is saved.

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Niagara Aero Heat Exchangers also give extra value in cooling jacket water for process equipment or engines, hydraulic equipment, electronic sets, controlled atmosphere processes, and many other applications.

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weighing capacity of 1,000 pounds or a counting ratio of 200 to 1. The counting scale will accurately count pieces weighing one ounce or more.

• QB 558 A new propeller-type *agitator* designed to mix materials having consistencies up to 4% is now being manufactured by E. D. Jones & Sons Co. This cartridge type unit is anchored in the wall of any chest or tank and is furnished with an electric alarm system which sounds a warning if the water supply, which lubricates the laminated plastic bearings, should fail.

It is of stainless steel and bronze construction, 5 to 15 hp required.

• QB 559 A new miniature Alnor Velometer, Jr. of the Illinois Testing Labs. is a portable, low-priced direct reading *air velocity meter.*

This palm-sized unit does not require

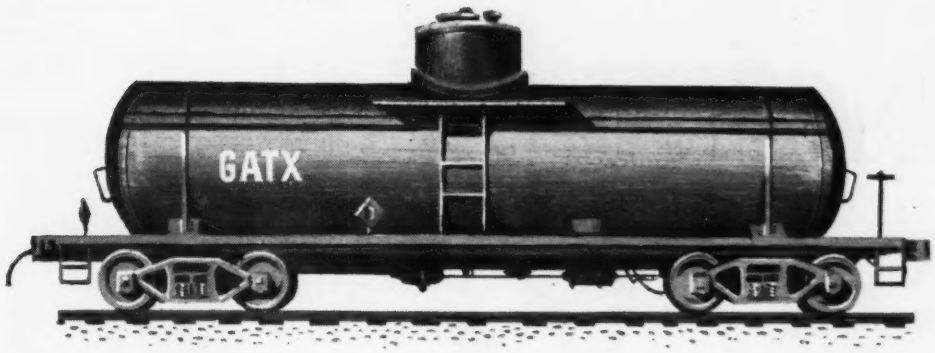
jet attachments and is completely self-contained. It is 4" high, 3" wide, 1½" deep and weighs only 8 oz. with single or double velocity range scales.

• QB 560 General Electric's Metallurgy Div. has perfected a method of sintering *Alnico* 5, a permanent magnet material, which permits the design of intricate shapes with lighter external energy than heretofore possible. The material is especially adaptable where small powerful magnets having high magnetic properties are required.

• QB 561 A new product has been manufactured by Eutectic Welding Alloys Corp. called *"Anti-Capillary Compound."* For use with Eutectic low temperature welding rods, this paste is designed to confine the flow of molten alloys to the limited area upon which the weld is to be applied.

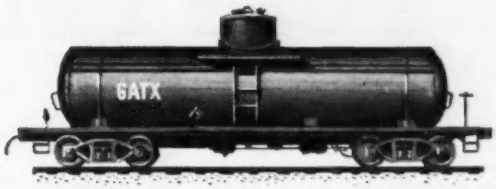
It also protects the parent metal from discoloration at welding temperatures and thus assists in retaining the cleanliness and brightness of the metal. In addition, the possibilities of distortion are greatly lessened.

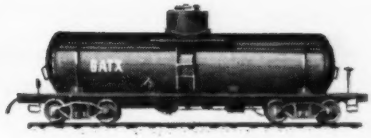
It may be applied by painting or spray-



General American

is filling the gaps in the tank car supply as rapidly as possible





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ISELIN-JEFFERSON CO., INC.

Sole Selling Agents

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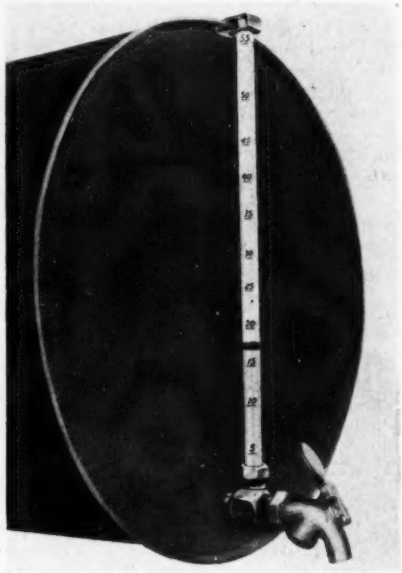
ing with any type brush and be removed by mechanical action, quenching, wire brushing or sand blasting.

• QB 562 Mastercraft Products has introduced a new *drum gage* to measure the contents of 55 gal. drums.

The "Tru-Oil-Gage", with no mechanical moving parts, accurately indicates the drum reserve at a glance. It is practically indestructible and can be used indoors or out.



• QB 563 The Michigan Wire Cloth Co. is in production on their new "Michigan Specification No. 4200" *wire cloth*.

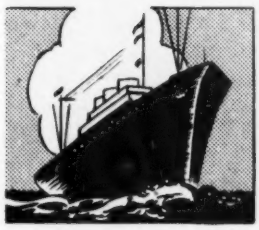
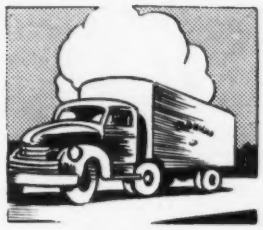
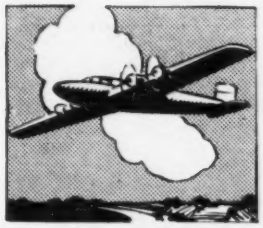
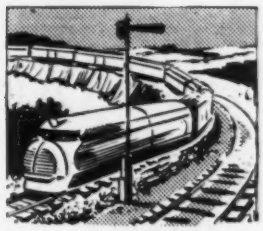
The manufacturers state that Specification No. 4200 is equal to 200 mesh in filtering and straining action, yet it is seven times as strong. The new material lasts considerably longer than 200 mesh, and it always lays flat. It is available in Monel metal and brass, and in other metals to special order.

• QB 564 Industrial Process Engineers have introduced an improved *turbine agitator* for operations where high heat transfer rates are required.

The agitators can handle highly viscous suspensions up to approximately 100,000 centipoise.

Three styles are available—the pitched blade type which provides axial flow with a high degree of up and down motion for handling materials with varying densities and/or viscosities – the curved blade type for use when radial flow is important – the combination pitched and curved blade type for axial and radial flow characteristics in one unit to provide better agitation and mixing where the spread in viscosity and density are not too great.

Cantilever supports with external bearings can be provided. For low headroom applications, I.P.E. builds special right angle vertical drives with wide spread anti-friction bearings, permitting shafts up to 20′ long.

BY SHIP · · · TRUCK · · · PLANE · · · OR TRAIN

SHIP YOUR PRODUCTS IN Fulton WATERPROOF Bags

You will find Fulton Waterproof Bags ideal containers no matter how you ship your products. Sift-proof and moisture proof, Fulton Waterproof Bags are unexcelled for packing and shipping chemicals or any product where dusting or control of moisture content is a consideration. Fulton Waterproof Bags are tough but light for safe and easy handling and storing. Fulton Artcraft Printing gives your brand a plus advertising value. Contact our plant nearest you.

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60% METHYL ETHYL KETONE PEROXIDE IN DIMETHYL PHTHALATE

WATER WHITE LIQUID

11% ACTIVE OXYGEN

LOW TEMPERATURE CATALYST FOR POLYESTER RESINS

TECHNICAL DATA AND SAMPLES AVAILABLE UPON REQUEST

*REGISTERED TRADE MARK

TRADE MARK

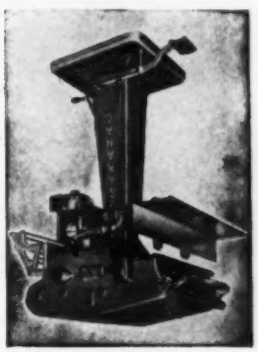
LUCIDOL DIVISION

NOVADEL-AGENE CORPORATION
BUFFALO 5, NEW YORK

"SARANAC D-10" for fast-SIFT-PROOF-economical BAG CLOSURES . . . . . .

A single pass through the Saranac D-10" gives a stout, siftproof closure as fast as the operator can feed—up to 75 per minute. The double-reverse fold is formed automatically and locked with one to six staples driven simultaneously.

Get full information TODAY on the Saranac system for speedier packaging at less cost. Ask for Bulletin 154.



Saranac D-10" Bag Sealer

Here's How Saranac's Positive Seal Looks—No Chance for Leakage.

SARANAC MACHINE CO

BENTON HARBOR, MICHIGAN

PACKAGING & SHIPPING

by T. PAT CALLAHAN

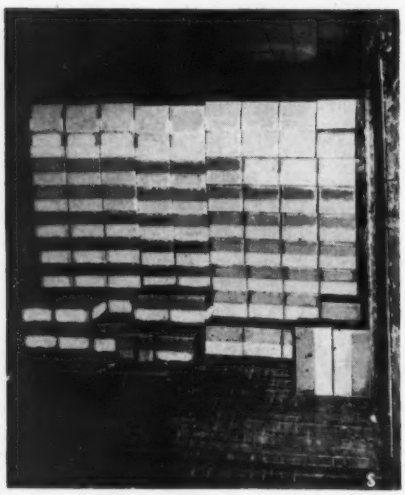
Covered Floor Racks Reduce Losses

In continuation of the discussions which have appeared here previously, the accompanying documentary picture story, prepared under the auspices of the Shipping Container Institute, 475 Fifth Ave., New York 17, New York, points out further causes of damage in shipment if proper attention is not made to the preparation of a car.

Failure to cover floor racks when shipping fibre boxes in refrigerator cars is an important factor contributing to the high rate of damage to packaged freight moving by rail. This is revealed in this fifth of a series of photographs released by the Institute.

These photographs show actual conditions found in some of the 700 freight cars inspected as a part of the Institute's nation-wide survey of shipping practices. The life-cycle of over 860,000 fibre shipping containers has thus far been studied.

Either because of the perishable nature of the commodity, or because of the freight car shortage, which forces a shipper to use whatever type car is available, it is frequently necessary for corrugated fibreboard boxes to be loaded in refrigerator cars equipped with floor racks. When this occurs, the shipper should see to it that the racks are covered with sheets of corrugated board or flattened boxes. If this is not done, the cartons will not only be dented and creased by the open racks, but are very apt to wedge in the spaces between slats and cause considerable damage when the load shifts during transit.



Sheets of corrugated board over floor racks would have protected lower cartons.

Cartons in lower layer of shipment catch in racks as load shifts and burst open.

Cartons show indentation of floor racks. Broken gaps in racks also cause damage.

New Roller Conveyor Curve

The Alvey-Ferguson Co., Cincinnati 9, Ohio, has recently perfected a V-belt driven live roller curve section. These sections are now available for use with present conveyor installations or for incorporation in future conveyor planning.

In the past, power curves have presented numerous problems in design and operation. Costly, cumbersome bevel gear arrangements have been employed by some manufacturers. In other cases, flat belts and chains have been used with varying degrees of success, but first cost and maintenance have always been a factor preventing more general use.

The Alvey-Ferguson roller curves are driven either from an adjacent conveyor or an independent motor through chain or sprocket to a heavy-duty V-belt, which provides friction drive to the lower side of the load rollers. The V-belt rides in precision sheaves mounted to guide the V-belt around the arc of the curve. These ball bearing sheaves are intermittently spaced below the driving V-belt and provided with vertical adjustment to maintain pressure against the load rollers, assuring a practically positive drive, yet no damage results should the conveyor continue to run after the line becomes blocked. Tension of the V-belt is easily and quickly altered by a tension adjustment. The A-F live roller curve is constructed to be easily combined with other of the company's sections.

Tank Car Picture Brighter

Delivery of tank cars during the first four months of this year were nearly two and one-half times the production rate of a year ago, according to the American Railway Car Institute.

The total produced through April was 2,084, as compared with 852 during the same period in 1947.

Deliveries of all types of freight cars have averaged 9,088 monthly during the last six months. Tank cars still remain a critical problem for the chemical industry, but the report of the American Railway Car Institute clearly shows the production figures which, in time, should relieve this critical shortage.

Truck Handles Carboys Safely

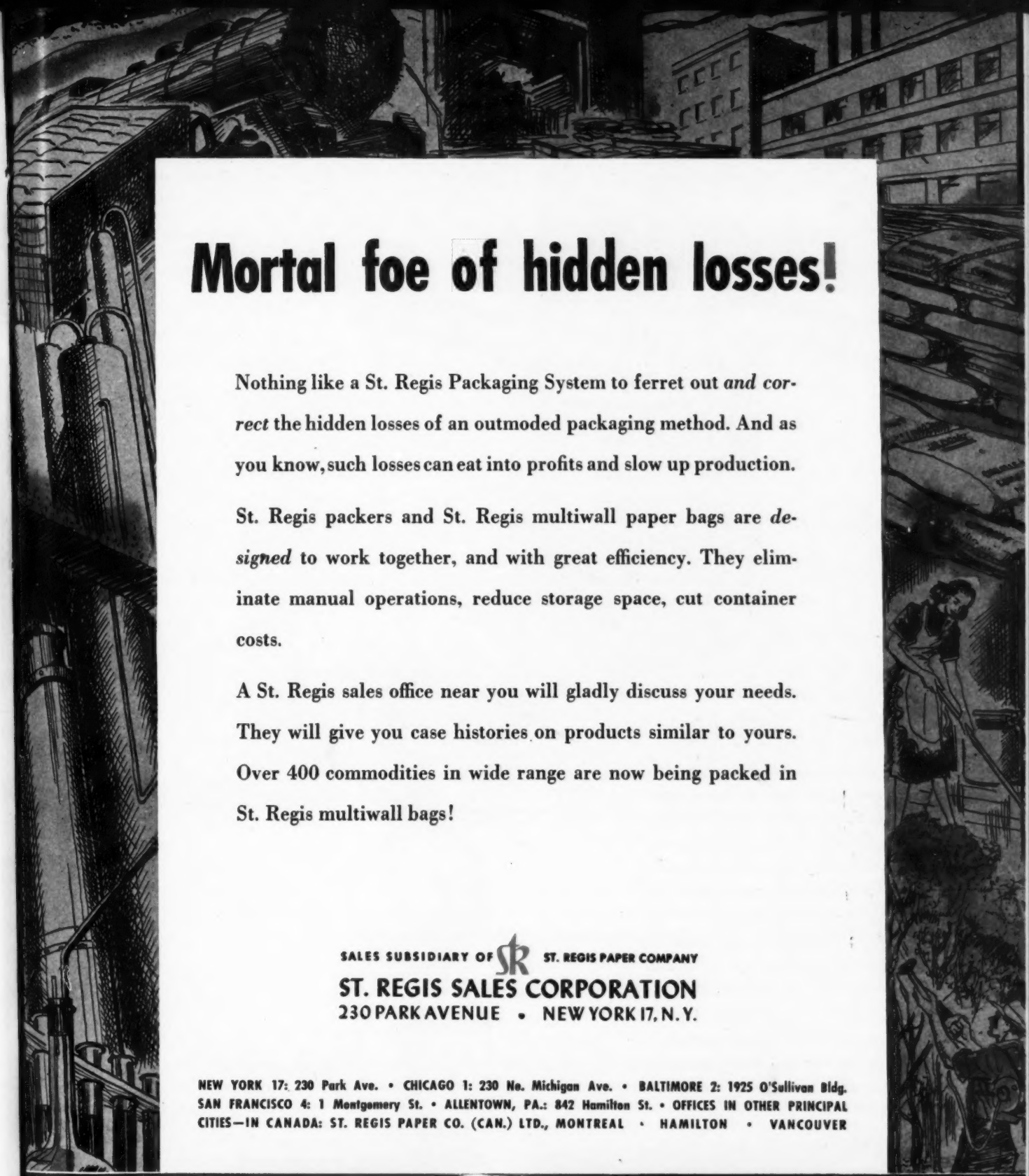
A truck designed to speed up the handling of dangerous chemicals or any liquid generally encased in a carboy has been developed by the Palmer-Shile Co., 16040 Fullerton Avenue, Detroit 27, Mich.

The truck is rolled up against the carboy and a handy gripping yoke is dropped over the top; the truck handles are pulled back and loading becomes automatic. Hardened steel studs on the truck frame hold load in place. To unload, the truck is simply tipped forward and the gripping yoke released. This truck will save a lot of dangerous, heavy lifting, avoid costly accidents, and speed up an otherwise slow and cumbersome task.

Rubber, pneumatic or metal wheels are available depending on individual requirements. Capacity is 500 lbs; weight, 75 lbs.

Bureau of Explosives Issues Annual Report

The Annual Report of the Bureau of Explosives, signed by H. A. Campbell, Chief Inspector, has been issued and is



Mortal foe of hidden losses!

Nothing like a St. Regis Packaging System to ferret out *and correct* the hidden losses of an outmoded packaging method. And as you know, such losses can eat into profits and slow up production.

St. Regis packers and St. Regis multiwall paper bags are *designed* to work together, and with great efficiency. They eliminate manual operations, reduce storage space, cut container costs.

A St. Regis sales office near you will gladly discuss your needs. They will give you case histories on products similar to yours. Over 400 commodities in wide range are now being packed in St. Regis multiwall bags!

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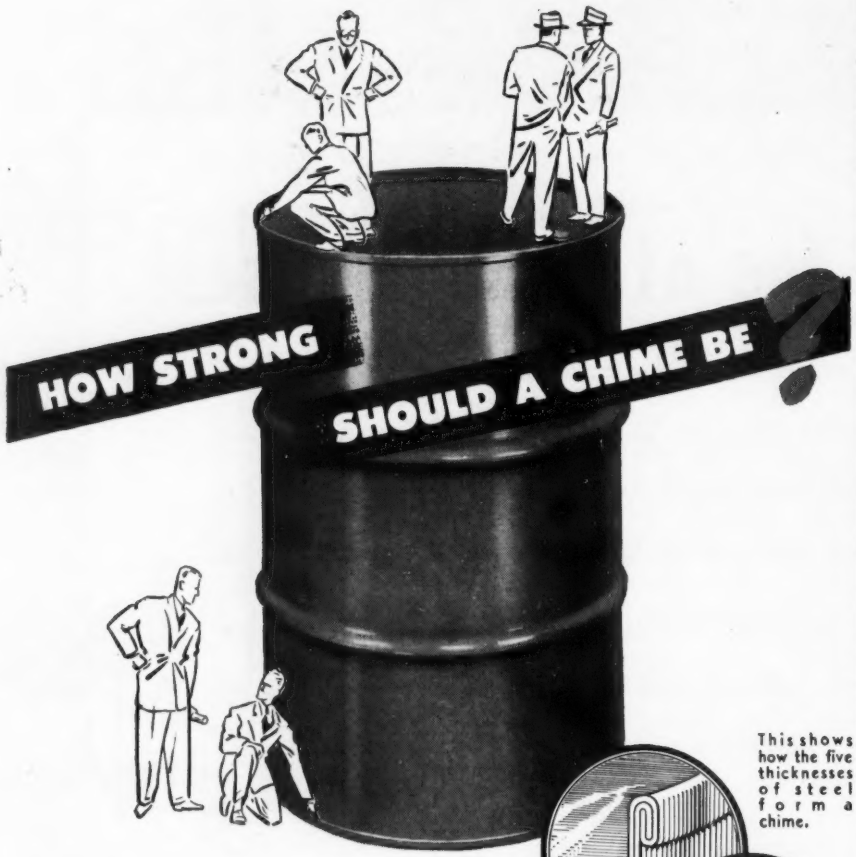
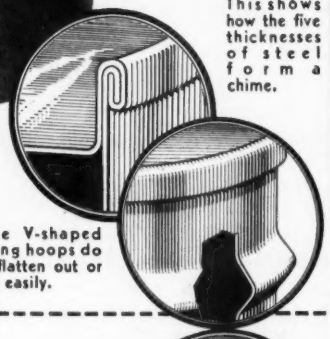
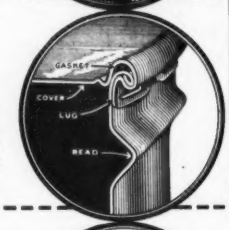
ST. REGIS PACKAGING SYSTEMS



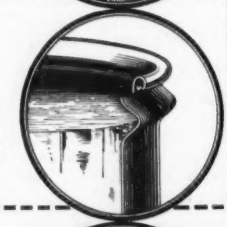
This shows how the five thicknesses of steel form a chime.



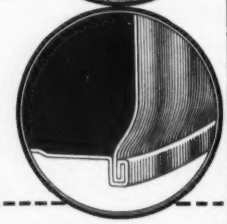
These V-shaped rolling hoops do not flatten out or dent easily.



Section through lug type closure that is liquid-proof, airtight and siftproof.



Protection bead on pails adds materially to its strength and utility.



Offset bottom, an important design feature of all Inland Steel Container pails permits containers to be stacked and rolled together.

Strength in the chime is a major factor in establishing the strength of the container. Inland Steel barrels, drums and pails have a chime formed by five thicknesses of steel joined together by the double-seaming method, producing an unusually strong joining of the head and body of the container — strong enough to stay leakproof under the rough handling encountered in shipping. At regular intervals in the manufacture of Inland Steel barrels, drums and pails, sections of these extra strength chimes are cut and tested to make certain they are being perfectly formed.

Emphasis on strength in the design and structural features of Inland Steel Containers have won the unqualified preference of America's manufacturers and shippers.

INLAND STEEL CONTAINER CO.

Container Specialists

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PLANTS AT: CHICAGO • JERSEY CITY • NEW ORLEANS

entitled B. E. Report No. 41. Following are quoted passages which are believed to be of much interest to the chemical industry:

The report covers the operations of the Bureau of Explosives both in the United States and Canada for the year 1947 and a compilation of reported accidents that occurred in transportation in which explosives, or dangerous articles other than explosives, were involved.

SUMMARY OF ACTIVITIES

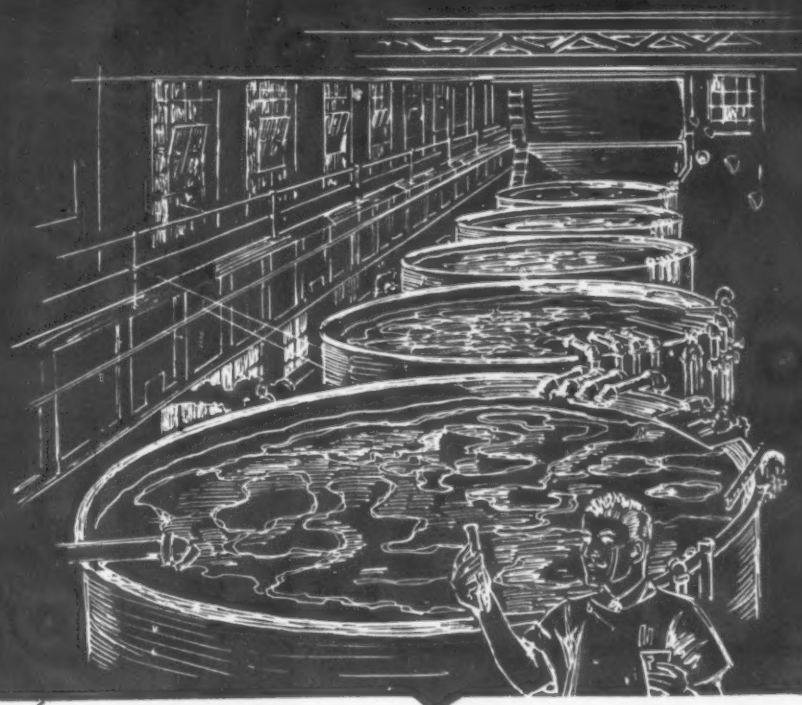
	1947	1946
Full and Associate Members, Bureau of Explosives	308	309
Railroads, Affiliated members of Bureau	6	6
Steamship lines, members of Bureau	1	1
Express companies, members of Bureau	3	3
Affiliate members of Bureau	102	102
Bureau Inspectors in field work	36**	37*
Total number of routine inspections	31,924	28,556
Railroad freight stations	5,860	5,436
Railroad yards	1,976	1,885
Explosive factories, refineries, acid, compressed gas plants, etc.	1,439	970
Express offices and depots	2,297	2,177
Steamship piers	10	12
Storage magazines for explosives	597	572
Tank car loading or unloading locations	1,799	1,109
Cars containing explosives	484	1,207
Cars containing dangerous articles other than explosives	17,003	14,540
Other inspections	459	648
Cars containing explosives showing serious violations of the regulations	47	138
Boxes of high explosives condemned as unsafe for transportation	2,462	82
Kegs of black powder condemned as unsafe for transportation	28	11
Conferences with railroad officials	6,230	7,026
Conferences with express officials	828	938
Conferences with shippers, container manufacturers, etc.	9,628	11,913
Lectures and meetings addressed on the subject of safe transportation of explosives and other dangerous articles	115	97
Attendance at the lectures and meetings	4,387	4,405

* 4 Inspectors with 6 months' service or less.
** 1 Inspector with 6 months' service or less.

There were no persons killed or injured due to the rail transportation of commercial explosives during 1947, marking the completion of the 26th consecutive year in transportation of Class A commercial explosives. The total reported property loss resulting from the transportation of explosives of all kinds, including fireworks and ammunition, was less than $500 and is slightly more than one-tenth of one per cent of the property loss resulting from the transportation of dangerous articles of all kinds. Statistics show that there were more than 606,870,000 pounds of commercial explosives produced in the United States during the year. This compares with a production of 517,773,000 pounds in 1946, and 406,671,000 pounds in 1940 which is considered the last near normal pre-war year for the industry. The production of commercial explosives far exceeded

STAUFFER CHEMICALS

FOR THE SOAP AND ALLIED INDUSTRY



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SOAP

Soapers specify Stauffer Chemicals because they have learned to depend on this dependable source of supply for quality chemicals in quantity. But whether you are a customer of chemicals for the soap kettle or have use for any of our comprehensive list of industrial chemicals, there's a Stauffer office and plant conveniently nearby to serve you better.

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BHC—Benzene Hexachloride
Boric Acid—Borax
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Chlorine
*Toxaphene (Chlorinated Camphene)
Citric Acid
Cream of Tartar
Silicon Tetrachloride
Sodium Hydrosulphide
Stripper, Textile
DDT—Dichloro-Diphenyl Trichloroethane
Sulphur
Sulphuric Acid
Sulphur Chloride
Tartaric Acid
Titanium Trichloride

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Newark

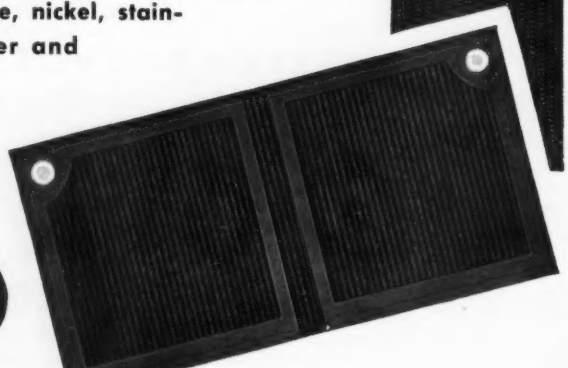
ACCURATE MESH

DURABLE WEAVE

METALLIC FILTER CLOTH

Newark metallic filter cloth is ideally suited for use in the process industries. It is woven firmly and uniformly with carefully selected and annealed wire and has the special Newark overlap weave for strength and exceptionally long service life.

Newark metallic filter cloth is available in the finest of meshes, in metals such as aluminum, brass, Monel, nichrome, nickel, stainless steel, gold, silver and platinum, in rolls or cut to fit your requirements.



NEWARK for ACCURACY

Newark Wire Cloth COMPANY

345 VERONA AVENUE • NEWARK 4, NEW JERSEY

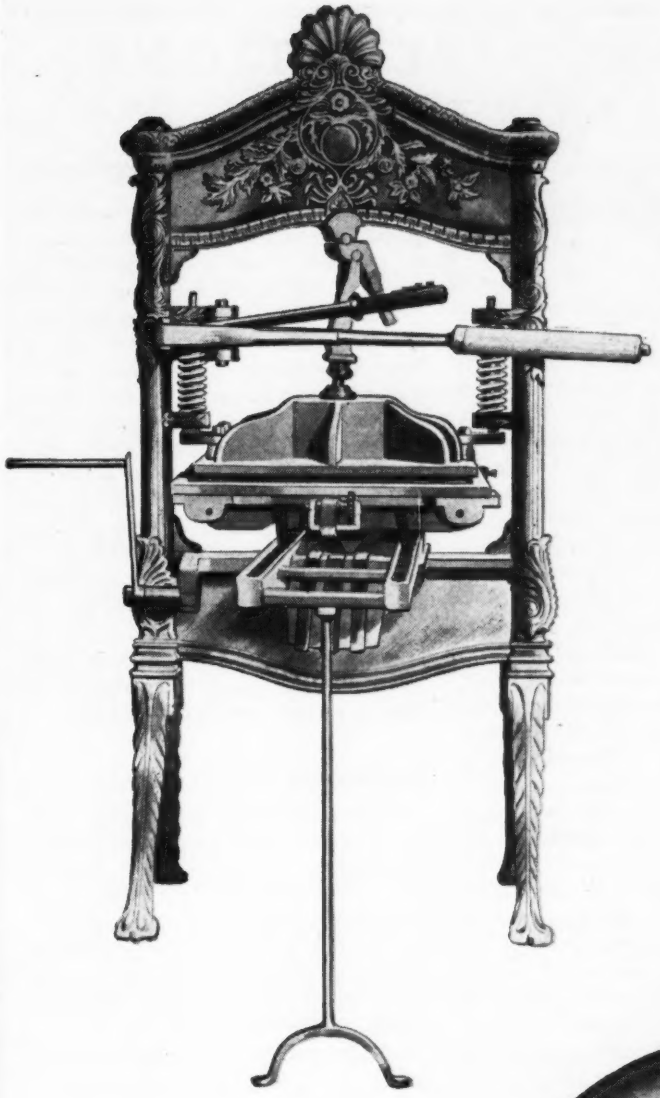
the production of any previous year in the history of the country.

One fire and three explosions were reported during the year resulting from the transportation of fireworks with a total property loss of $39. Two other accidents were reported resulting from the transportation of loaded firearms causing slight injuries to two express employees and properly chargeable to negligence on the part of the shippers and their failure to comply with Interstate Commerce Commission Regulations. $386 of the property loss chargeable to the transportation of explosives resulted from damage to containers or contents, from causes other than fires or explosions and in each instance where the cause could be determined interested parties have been instructed by inspectors of this Bureau so as to avoid similar failures in the future and possible serious accidents. The inspectors of this Bureau have continued to keep in close touch with all manufacturers and shippers of explosives of all classes to see that shipments are properly prepared for transportation. Samples of explosives and explosive devices have been selected from each manufacturer and examined in the Bureau's laboratory during the year.

The headquarters and laboratory staffs have conferred with railroad officials and advanced the investigation of the need for more rigid specifications for railroad fuses. The study included the development of a standard means for determining color and intensity of light from these devices.

Following the disaster at Texas City, Texas, the Bureau of Explosives was called upon to conduct an appreciable amount of experimental work with ammonium nitrate and ammonium nitrate fertilizer, and two members of its staff have been appointed to serve on the Federal Interagency Committee to assist in its investigation. The ammonium nitrate fertilizer which was involved in the Texas City disaster was not in rail transportation at the time, and part of the investigation conducted by the Bureau was for the purpose of determining whether the material can explode under conditions incident to rail transportation. While fires have been reported in rail shipments, and all reported fires have been investigated by inspectors of the Bureau, it was developed that fires were caused by sparks or flame from an external source, and in no instance has any explosion resulted from such fires nor do tests indicate that explosions will occur under these conditions. It has been concluded that classification of this material as an oxidizing material is proper, and provided reasonable precautions are taken in transportation to avoid ignition of the outside containers, fires should not occur. Some safety recommendations

(*Turn to page* 124)



Screw hand press

Squaring shears

Tinsmith by necessity!

Using a screw hand press . . .

. . . a pair of squaring shears . . .

. . . and other simple tools . . .

. . . *the fishermen and canners of another day were ready to start canning, if they could find the proper raw materials.*

Yes, they had to be tinsmiths, too.

This *was* the situation in the fishing industry. Canco overcame it.

Canco developed machines to make cans for tuna, salmon, mackerel, sardines, and many other kinds of fish . . .

. . . besides machines to close these cans up to 175 per minute.

Canco sent out expert servicemen to the fisheries themselves, ready to help Canco customers.

Indeed, Canco has played such an important role in the fishing industry as it is known today that we rightly feel ourselves an integral part of it.

The willingness to do new things . . . to pioneer . . . is part of Canco. Fishing is only one frontier of packaging where we have helped our customers.

CANCO

AMERICAN CAN COMPANY

New York • Chicago

San Francisco

CAMPHENE

now available in tank cars or drums!

CAMPHENE

C_{10} H_{16}

THE GLIDDEN COMPANY announces the addition of Camphene to its series of terpene chemicals including Alpha Pinene, Beta Pinene and Dipentene that are now being produced on a commercial scale at its Naval Stores Plant in Jacksonville, Florida. Glidden Camphene is available in drum and tank car quantities, marking the first time that this interesting and reactive product has been freely offered in large volume and high purity in the United States.

Camphene is suggested as a raw material for the manufacture of plasticizers and synthetic essential oils. Its high chemical reactivity makes possible its application in the synthesis of novel and useful products.

For further information and samples write:

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UNION COMMERCE BUILDING
CLEVELAND, OHIO

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PLANT OPERATIONS NOTEBOOK

Industrial Dust and Fume Control

The effective control of industrial dusts and fumes by exhaust systems depends upon confining or housing the source and establishing a proper air movement through the hoods or housings to the exhaust piping system. This principle is being stressed in the work of the Sectional Committee on Safety Code for Exhaust Systems, Z9. This committee represents 24 national governmental, technical and trade organizations and is now working on the development of a Safety Code for Exhaust Systems.

At a recent meeting of the committee, working under the American Standards Association, it was agreed and strongly advocated that manufacturers of dust-producing equipment should provide housings or hoods as an integral part. In the opinion of the committee there is little more reason for such equipment being furnished without provisions for effective dust and fume control than for furnishing equipment with unguarded gears. The manufacturer has intimate knowledge of the operating action of his equipment, the air currents which it may create, and the access points needed for inspection, adjustments, and maintenance. Thus, by cooperating with dust and fume control engineers effective enclosures or housings with provisions for proper exhaust system connections can be provided as an integral part of the machines. While this may result in some increase in the purchase price, the overall cost to the ultimate users should be less. Some means of controlling fumes and dust must be provided locally if not furnished with the equipment. Such locally added exhaust hoods are a compromise, at best, because of improper design and fabrication. Provision in the field means a "cut and try" procedure at considerable expense, in some cases resulting in interference with equipment operation, adjustment, and servicing. In some cases this leads to their removal. If furnished with integral, well designed enclosures and initially installed with these provisions, removal is unlikely.

Housekeeping

To focus attention on the special problem of housekeeping, the National Safety Council has prepared Package Program No. 1. This contains a time table, sample management letters to start the program and, to sum up the results, a plant inspection check list, samples of program and technical materials along with suggestions for their use.

Sample packages are available on request.

NOMOGRAPH-OF-THE-MONTH

Edited by DALE S. DAVIS

Readers are invited to submit for publication in this department any original nomographs pertaining to chemistry or engineering. $10 *will be paid for each one used.*

Nomograph to Determine the Time Required for Blending

by A. D. SNYDER and D. S. DAVIS
Government Laboratories,
University of Akron, Akron, Ohio

WHEN the contents of two tanks are mixed by pumping from each to the other, it is often necessary to calculate the time of pumping required for a certain degree of uniformity. Consider that R units per minute are pumped from tank 1 into tank 2 and from tank 2 into tank 1. Let A = the number of units of material I in tank 1 after θ minutes and A_o = the number of units of material I initially in tank 1 and the number of units of material II initially in tank 2. Then $A_o - A$ = the number of units of material I in tank 2 after θ minutes. Neglect the small amount of material in the pump and short connecting pipes.

For either inflow or outflow, weight = (rate) (concentration) (time). A material balance for tank 1 yields the equation,

Increase in I = inflow − outflow.

Substituting the equations

$$\text{Outflow} = R\,\frac{A}{A_o}\,d\theta \qquad \text{and}$$

$$\text{Inflow} = R\left(\frac{A_o - A}{A_o}\right) d\theta$$

IF ALL ANIMALS HAD LONG NECKS

there wouldn't be enough leaves to go around . . . .

AND . . . when it comes to NITROGEN . . . everybody's got a long neck . . . THERE AREN'T ENOUGH LEAVES TO GO AROUND! Everybody wants NITROGEN.

During this period of "UNPRECEDENTED DEMAND" producers of AMMONIA . . . the #1 source of NITROGEN . . . are producing tremendous quantities of this basic chemical product for AGRICULTURAL AND INDUSTRIAL needs. Twice-the-production than ever before!

Since . . . this isn't enough . . . since there must be MORE LEAVES . . . Spencer Chemical Company is NOW constructing facilities to increase its current production of chemicals for industry and agriculture.

Naturally, like most current production, all demands cannot be met. BUT, Spencer will continue to try to satisfy AS MANY CUSTOMERS AS POSSIBLE . . . looking forward to the day when SUPPLY and DEMAND are stabilized . . . to the day when all of the customers can get ALL THE LEAVES THEY WANT!

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in the material balance yields

$$\text{Increase in I} = dA = R\left(\frac{A_o - A - A}{A_o}\right)d\theta$$

$$= R\left(\frac{A_o - 2A}{A_o}\right)d\theta$$

In the time θ, A changes from A_o to a fraction f of A_o:

$$\int_{A_o}^{fA_o} \frac{dA}{A_o - 2A} = \int_{O}^{\theta} \frac{R}{A_o}\, d\theta$$

Integrating,

$$-\frac{1}{2}\ln (A_o - 2A)\Big|_{A_o}^{fA_o} = \frac{R}{A_o}\Big|_{O}^{\theta}$$

$$-\frac{1}{2}\ln \frac{A_o - 2fA_o}{A_o - 2A_o}$$

$$= -\frac{1}{2}\ln (2f - 1) = \frac{R}{A_o}\theta$$

$$\text{from which } \theta = -\frac{A_o \ln (2f - 1)}{2R}$$

$$= -\frac{2.303\, A_o \log (2f - 1)}{2R}$$

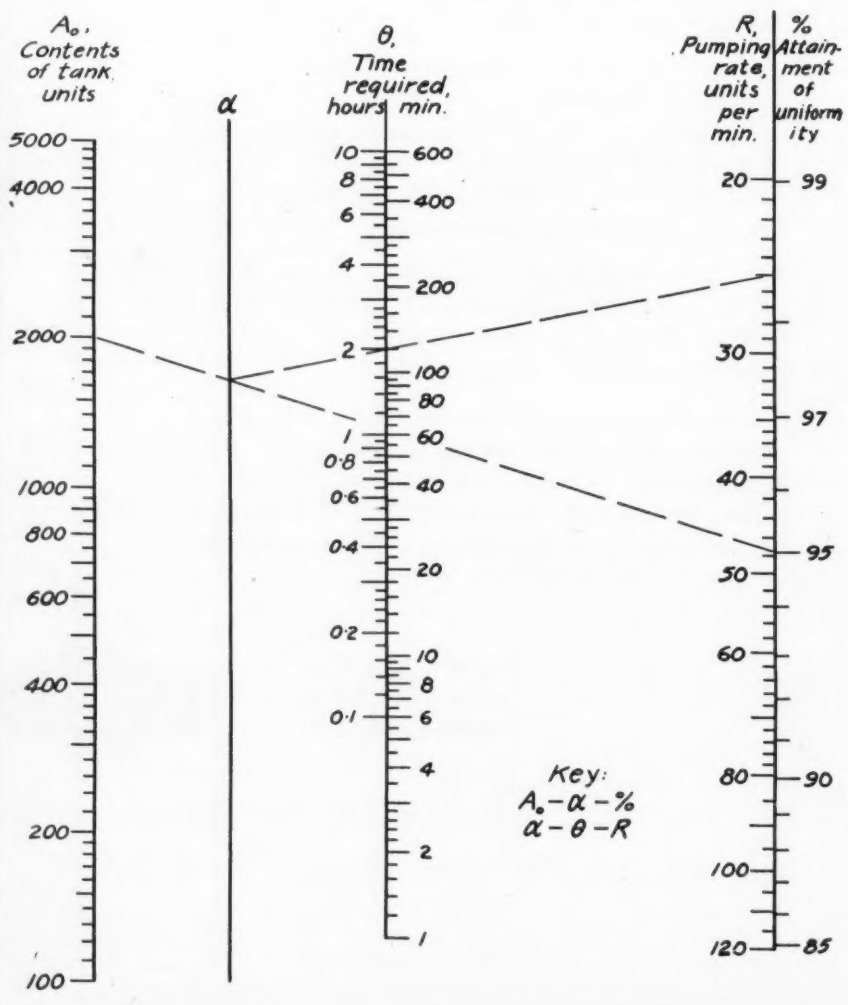
$$= -1.152\,\frac{A_o}{R}\log (2f - 1)$$

This equation can be solved conveniently and accurately by means of the accompanying alignment chart which was constructed by methods previously described (1). The use of the chart is illustrated as follows: Tanks 1 and 2 contain 2000 units of materials I and II, respectively. The contents are mixed by pumping from each to the other at the same rate: 25 units per minute. How long should pumping proceed to attain 95 per cent uniformity in the two tanks? Percentage uniformity is given by 200 (1 − f). Following the key, connect 2000 on the A_o scale with 95 per cent on the scale devoted to percentage attainment of uinformity and not the intersection with the α axis. Connect this intersection with 25 on the R scale and read the desired value as 120 minutes or 2 hours on the θ scale.

For 98 per cent uniformity (for which f = 0.51) it is interesting to note that the equation $\theta = 1.96\ A_o/R$ or that the time required is approximately twice the ratio of the initial content and the pumping rate.

Literature Cited

(1) Davis, D. S., "Empirical Equations and Nomography", Chap. V, New York, McGraw-Hill Book Co., (1943).



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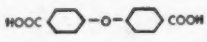
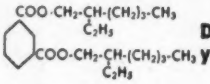
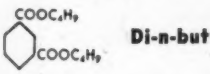
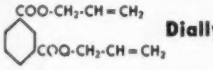
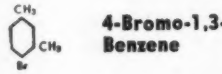

4,4' Dicarboxy diphenyl ether

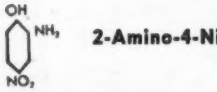
Bromo - tere - phthalic acid


Di (2-ethyl hexyl)-iso-phthalate


Di-n-butyl-iso-phthalate

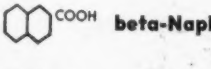

Diallyl-iso-phthalate

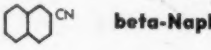

4-Bromo-1,3-Dimethyl Benzene


2-Amino-4-Nitrophenol

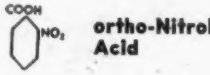
$CH_3(CH_2)_8CHO$ n-Decyl Aldehyde

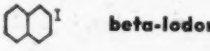
alpha-Naphthoic Acid


beta-Naphthoic Acid

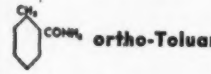

beta-Naphthonitrile

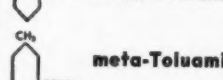
para-Bromobenzonitrile


ortho-Nitrobenzoic Acid


beta-Iodonaphthalene

para-Toluamide


ortho-Toluamide


meta-Toluamide

45 OTHER RARE ORGANIC CHEMICALS

Send for Products List

Inquiries for other rare organics invited.

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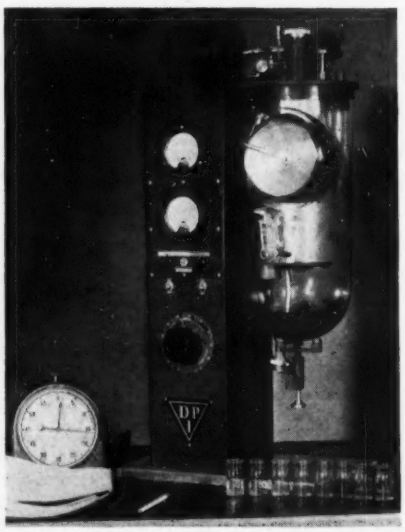
LABORATORY NOTEBOOK

Molecular Still for Laboratory Bench

For the first time, a unit for distilling fats, oils and waxes by molecular distillation at the laboratory bench has been made available by Distillation Products, Inc., 755 Ridge Road West, Rochester 13, N. Y.

The new unit model, Type CMS-5, employs a centrifugal evaporator embodying the same principles as D.P.I.'s



large commercial stills, enabling the results obtained in the laboratory to be translated into terms of commercial production.

An illustration of the new piece of equipment is shown above.

The CMS-5 has the unique distinction of operating with the least danger to the substance under distillation of any still yet devised—hundreds of thousands of times less than the hazard of ordinary laboratory vacuum stills. In this respect it facilitates research in distillations which have never before been possible to carry out.

The evaporator of the Type CMS-5 molecular still consists of a conical rotor 5″ in diameter, warmed by an embedded heater. The condenser is formed by a flattened surface of the bell-jar which encloses the complete unit. The substance to be processed is contained in the bottom of the inverted jar from where it is fed, by a small pump, onto the center of the rotor. Centrifugal force spreads it in an extremely thin, uniform layer across the surface of the rotor. The distilland is in contact with the heated evaporator for a very short time—only 0.2 - 0.5 seconds.

The normal operating pressure of the CMS-5 still is 0.1 - 10 microns. This vacuum is achieved and maintained by a D.P.I. fractionating oil diffusion pump, operating in conjunction with a mechanical pump.

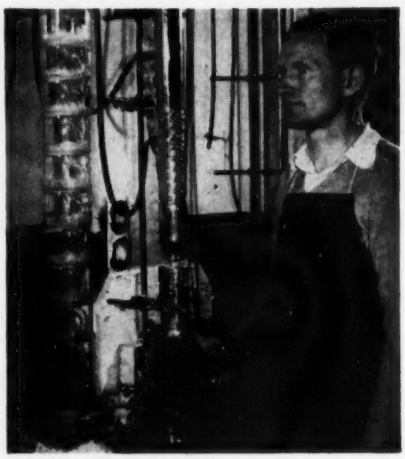
Samples of two liters or less may be readily handled in the CMS-5. A separate compartment collects the residue until a cycle is completed so that each fraction is a product of whole parent substance.

Thirty-two inches high, the still occupies about three square feet of bench space, exclusive of the mechanical pump which also covers an equal area. Meters and controls are mounted on a single panel and include a thermocouple dial, Pirani type vacuum gauge and a variac to control the temperature of the evaporator.

Glass Laboratory Fractionating Columns

Glass Engineering Laboratories, 521 O'Neill Ave., Belmont, Calif., has added two-inch and four-inch Oldershaw-type bubble-plate columns to the previously produced one-inch and three-inch diameter sizes.

The new two-inch size, like the one-inch, has a permanently-evacuated jacket for insulation. External heat is not required until the operating temperature exceeds 450° F. In the two-inch size, standard sections are supplied with 10, 15, 20, and 30 precision-drilled bubble plates—the 30-plate and longer special lengths being unjacketed. Sections are coupled together with standard-taper laboratory ground joints.



The four-inch size, like the three-inch, has industrial end fittings. It can be provided with 10, 15, and 20 precision drilled bubble plates. Pyrex glass is used and no metal touches the processed mate-

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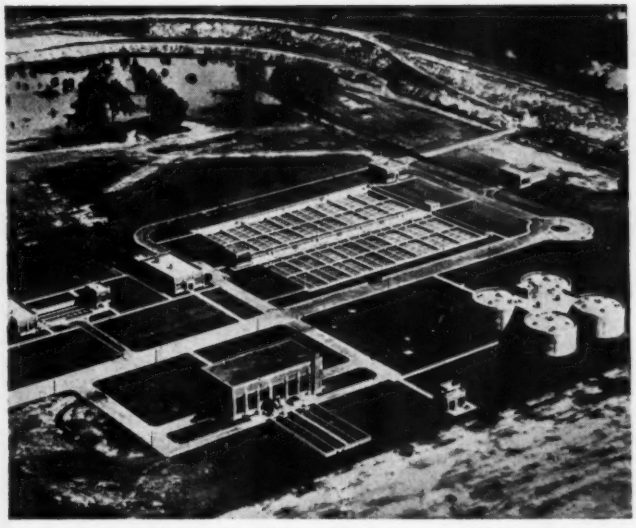
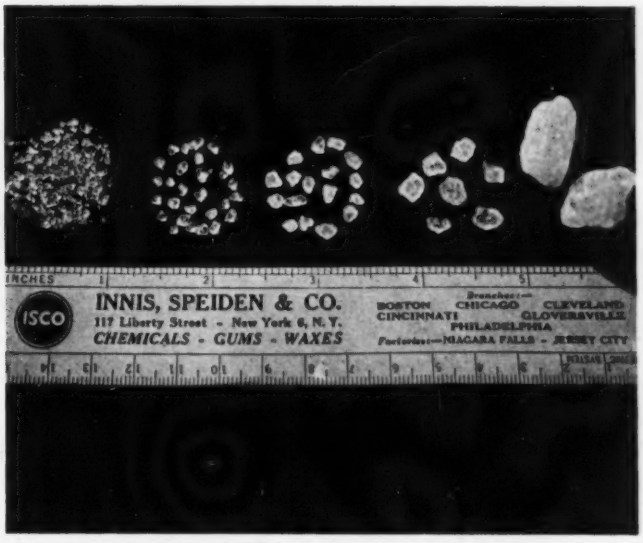
In the Chemical and Allied Industries

CHLORIDE OF LIME — $CaCl(ClO).4H_2O$. 35-37% Available Chlorine. Has many uses in sanitation, public health and industry. Used for bleaching and processing paper, textiles, in laundry bleaching, wherever sterilization is a problem such as water, dairies, etc., in manufacture of textiles, pulp, paper, chemicals, etc. Above, as used in paper processing.



FERRIC CHLORIDE—Sold in lumps and crystals in 500 lb. bbls. *Ferri-Cl*$_3$*or* is the ISCO coagulant for sewage and industrial wastes. Provides effective, economical means of increasing efficiency of the ordinary sedimentation plant. Coagulant for wide range of industrial wastes. Low-cost, powerful sludge coagulant. Write for free booklet. Above, typical sewage treatment plant using Ferrichlor.



PARADICHLOROBENZENE — Used in manufacture of dyestuffs, intermediates, organic chemicals, insecticidal & germicidal compositions, deodorant, soil fumigant, moth-proofing. Available in drums, barrels and kegs. Isco also has naphthalene and orthodichlorobenzene. Above, mixed fines; fine crystals; rice crystals; pea crystals; nuggets.

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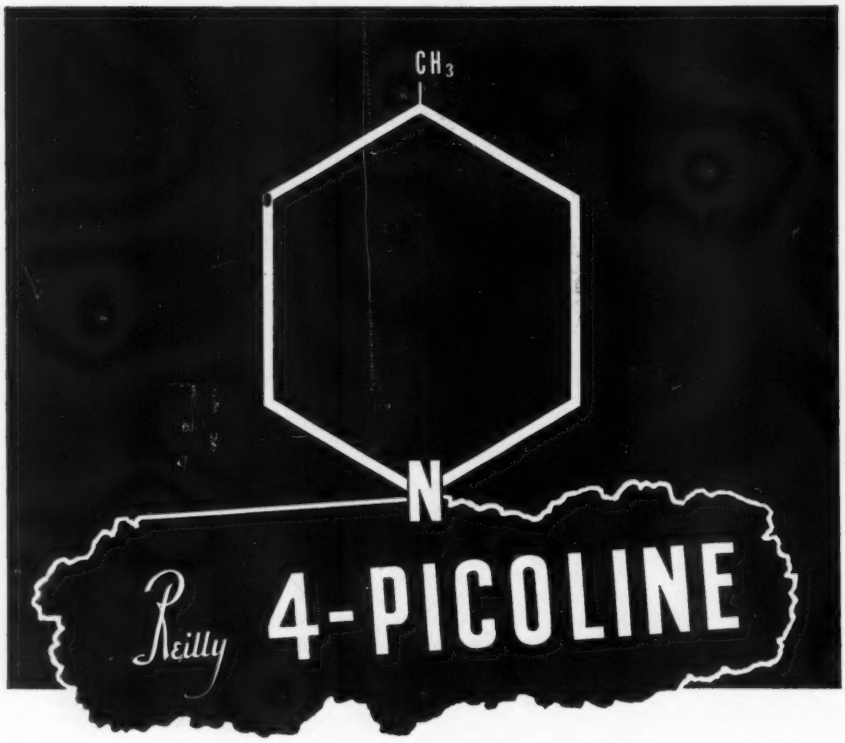

An Alkylpyridine With Many Interesting Properties

● Recent studies indicate that pyridine compounds having an alkyl group in the 4-position possess superior activities as medicinals, fungicides and insecticides.

One of these compounds, Reilly 4-Picoline, is readily oxidized, condenses freely with aldehydes, and forms quaternary salts with remarkable ease.

Research laboratories interested in the development of new pharmaceuticals, insecticides, anti-oxidants and rubber chemicals will find it well worth their while to investigate Reilly 4-Picoline.

Other Reilly Alkylpyridines are 2-Picoline, 3-Picoline, 2,6-Lutidine, 2,4-Lutidine, 2,4,6-Collidine, 2-Methyl-5-Ethylpyridine, 2-Amylpyridine, 4-Amylpyridine, 2-(5-Nonyl) pyridine, and 4-(5-Nonyl) pyridine.

Your inquiries on any of these compounds will have prompt attention.

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Reilly Coal-Tar Chemicals For Industry

rial at any point. Maximum contact between rising vapor and refluxing liquid is created by the large numbers of holes per plate: 300 for the 2-in. and 1000 for the 4-in.

The equilibration time is about 30 minutes and operating plate efficiencies range from 60 to 66 per cent at total reflux. The operating holdup per plate averages 6 ml on the 2-in. and 24 ml on the 4-in. Residual holdup is respectively 0.8 and 3.2 ml.

Electrolytic Film Determines Moisture

An improved method for measuring small amounts of water vapor in gases has been developed by E. R. Weaver of the National Bureau of Standards, Washington 25, D. C. This procedure depends on the change in electrical resistance of an electrolytic film as it absorbs water vapor. Such a method is readily adapted to numerous applications, such as measuring the moisture-permeability of membranes, detecting minute concentrations of combustible gas in air or of oxygen in combustible gas, measuring the capacity of drying agents, determining the water content of organic liquids and solutions, and measuring the relative humidity in small or comparatively inaccessible spaces under rapidly changing conditions.

A thin film of liquid, which may be phosphoric acid or a solution of sulfuric acid or other electrolytic compounds in a gelatin or plastic binding material, is spread over the surface of a solid insulator between metallic electrodes. The electrolyte in equilibrium with the water vapor in the surrounding gas forms a solution whose electrical conductance measures the concentration of water vapor in the gas. To utilize this phenomenon, some sensitive instrument for measuring or comparing electrical resistances and a means of calibrating the film by comparison with a gas of known moisture content are necessary. Because of polarization, alternating current must be used.

In its original form, the utility of the method was limited by the stability of the films. The wartime need for a method of determining the dryness of aviators' oxygen led to solution of another problem, rapid calibration.

In making a determination with this apparatus, either or both of the pressures of a sample of gas of known moisture content and of the unknown sample are adjusted until they have the same concentration of water as shown by equal electrical resistance of the detecting film. The water concentration of the known sample is readily computed from moisture content and volume and is, of course, equal to the water concentration of the unknown sample.

Hooker

Monochloracetic Acid

Every chemist knows of monochloracetic acid because this versatile chemical is such an important intermediate, is useful in so many different fields. But you may not know that Hooker is now in production on monochloracetic acid. A new, specially constructed plant is now turning out technical grade monochloracetic acid—a white crystalline material in fine, free flowing flake form.

Listed below are some of the physical and chemical characteristics and suggested uses for monochloracetic acid. Technical Data Sheet 752-A gives more complete listing of properties and Hooker specifications. It will be sent you when requested on your company letterhead.

DESCRIPTION: White crystalline material with a strong sweetish odor. Corrosive to the skin. Very soluble in water and benzene; soluble in most organic solvents.

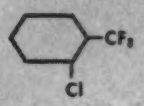
PHYSICAL DATA:

Mol. Wt.	94.5
M. P.	61.6°C
B. P.	189°C

USE: Intermediate in manufacture of carboxymethyl cellulose, 2, 4-dichlorophenoxy acetic acid, cyano acetate, indigoid and thioindigoid dyes, ammonium thioglycollate, thioglycollic acid, aminoacetic acid and other chemicals of commercial importance. It has been suggested as a preservative alone or in connection with other compounds for hides, skins, etc.

HOOKER RESEARCH Presents

o-CHLOROBENZOTRIFLUORIDE
(o-Chlorotrifluoromethylbenzene)



Molecular Weight	180.56
Freezing Point	-7.4°C
Boiling Point	152.°C
Specific Gravity, 15.5°/15.5°C	1.379
Refractive Index, n20/D	1.456

Another new Hooker product is offered to the chemical processing industries. Its properties indicate the possibility of many applications as a chemical or dye-stuff intermediate, solvent or dielectric fluid. o-Chlorobenzotrifluoride is a water-white, mobile, aromatic liquid. It is characterized by the trifluoromethyl radical which is generally very stable to heat, light and to chemical reaction.

Hooker o-chlorobenzotrifluoride is available in experimental quantities. Technical Data Sheet No. 363 describes more completely its physical and chemical properties. Please use your company letterhead when requesting sample or literature.

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HOOKER ELECTROCHEMICAL COMPANY

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Lithium Amide
Now in full-scale commercial use
MEMO
*APPLICATIONS
The stability of Lithium Amide, as compared to other amides, makes it absolutely safe to ship, handle and store. For numerous organic reactions, Lithium Amide is a convenient and instantly-available reagent. And in certain reactions, it produces a higher yield.
EXAMPLES
1. Claisen condensations.
2. Alkylation of nitriles and ketones.
3. Syntheses of ethinyl compounds and acetylenic carbinols.
MEMO
Li NH2 PROPERTIES
Molecular Wt.: 22.964
Melting Range: 380-400° C.
Density: 1.178 g./cc. at 17.5° C.
Heat of Formation: 42.6 kilocal./g. mol. at 18° C. and 1 atmosphere
Solubility:
pure ethyl ether
benzene
toluene
} Insoluble
water, hot or cold decomposes
LiNH2 + H2O → LiOH + NH3
Lithium Amide (Lump or powder)
Lithium Metal (Lump, wire or sand form)
Lithium Hydride
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INDUSTRY'S BOOKSHELF

Oil Policy

A NATIONAL POLICY FOR THE OIL INDUSTRY, by *Eugene V. Rostow*. Yale University Press, 1948. 173 pages. $2.50. Reviewed by Benjamin T. Brooks, consulting chemist.

THIS is the first of a series of studies in national policy by members of the Departments of Economics and Political Science, and the School of Law at Yale University. The present volume is sponsored by a committee consisting of Percy E. Corbett, Kent T. Healy, Harold D. Lasswell, John P. Miller and Eugene V. Rostow. The author states: "the purpose of this study is to investigate the forces which determine the level of prices and output in the petroleum industry; to examine the functioning of the system of law which defines public policy towards that industry; and to consider alternative courses of action for the industry which might be pursued in the national interest. . . . oil policy must be judged ultimately from the point of view of national security".

The scope of the book is indicated by the titles of the five parts: I. History, Geography, Technology and Law; II. The Controls of Crude Oil Production; III. Controlling the Product Markets; IV. Oil Abroad (The Foreign Oil Policy of the United States); V. Restoring Competition. "The conclusion of this study is that the oil industry is monopolistic in its organization to an important extent; that a more competitive form of organization would be economically and socially desirable, . . . that a reorganization of the industry in the interest of competition would not involve giving up the economics of the large scale production, or other technological advantages, but should on the contrary result in the elimination of important wastes associated with excessive size and monopoly."

The author appears to be concerned primarily with business practices and is of the opinion that the conduct of the industry today, at least of the larger companies, retains many of the characteristies and methods of operation of the Standard Oil Company prior to the dissolution of the so-called 'Standard Oil Trust'. "The imprint of this essential principle of company policy survives to this day."

The author has drawn information freely from sources including the O'Mahoney Hearings, the TNEC Hearings and Monographs and the Cole Committee Hearings. Even so, it is probably asking too much to expect a group such as the editorial committee at Yale University to be able to understand and properly evaluate the technological aspects of such an industry. Thus it would seem to be fundamental in considering such a subject, as the title of this volume, to give some consideration to questions like the adequacy of our reserves, whether they are adequate for the continued expansion of our demand, and whether or not we are and will continue to be in need of imports of oil from foreign fields and, if so, whether our national security is involved. The author appears to throw up his hands as indicated by the statement: "The difficulty with the problem is the unpredictability of the future. The literature about the extent of oil reserves is full of apparent controversy, the optimistic experts claiming that there is no chance of an oil shortage, the pessimists that a shortage at least of cheap oil is upon us."

Again, the author's understanding of technological fundamentals is indicated by his implication that we have so far only explored by drilling "about 1/200 of the area which the geologists say is likely to contain oil".

Nevertheless, the present volume is, in the opinion of the reviewer, a most excellent study of the American oil industry. The chapter on the foreign oil policy of the United States is most opportune.

Aluminum Cartel

THE ALUMINUM CARTEL, by *Louis Marlio*, Brookings Institution, Washington, D. C. 130 pgs. $1.50. 1947. Reviewed by Herman W. Zabel, Engineering Editor, Chemical Industries.

THIS IS a most interesting and factual account of the operations of the four aluminum cartels. Dr. Marlio served as chairman for the last thirteen years, until World War II forced its dissolution.

The author, as would be expected, is biased in favor of the cartel system of doing business. However, he does prove one of the major allegations against cartels, that is, that full data on production figures, new developments, etc. are known to each of the cartel members. The producers in the various countries were obliged to have an annual detailed inspection by a firm of consulting engineers. But, Dr. Marlio points out, France was warned of Germany's abnormal aluminum demands as early as 1934, again in 1935, 1936, 1937, 1938. Finally the increase in French aluminum production that took

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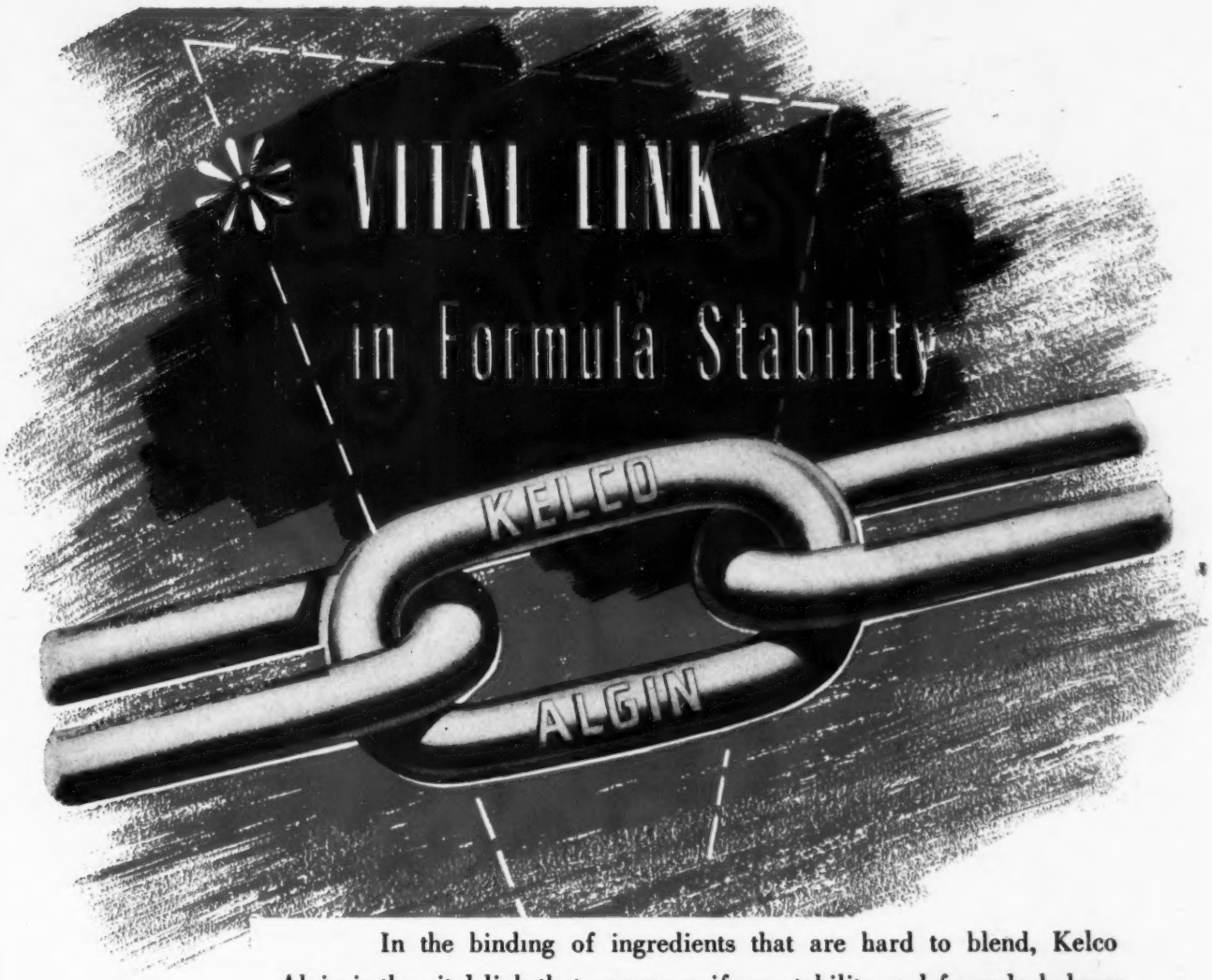

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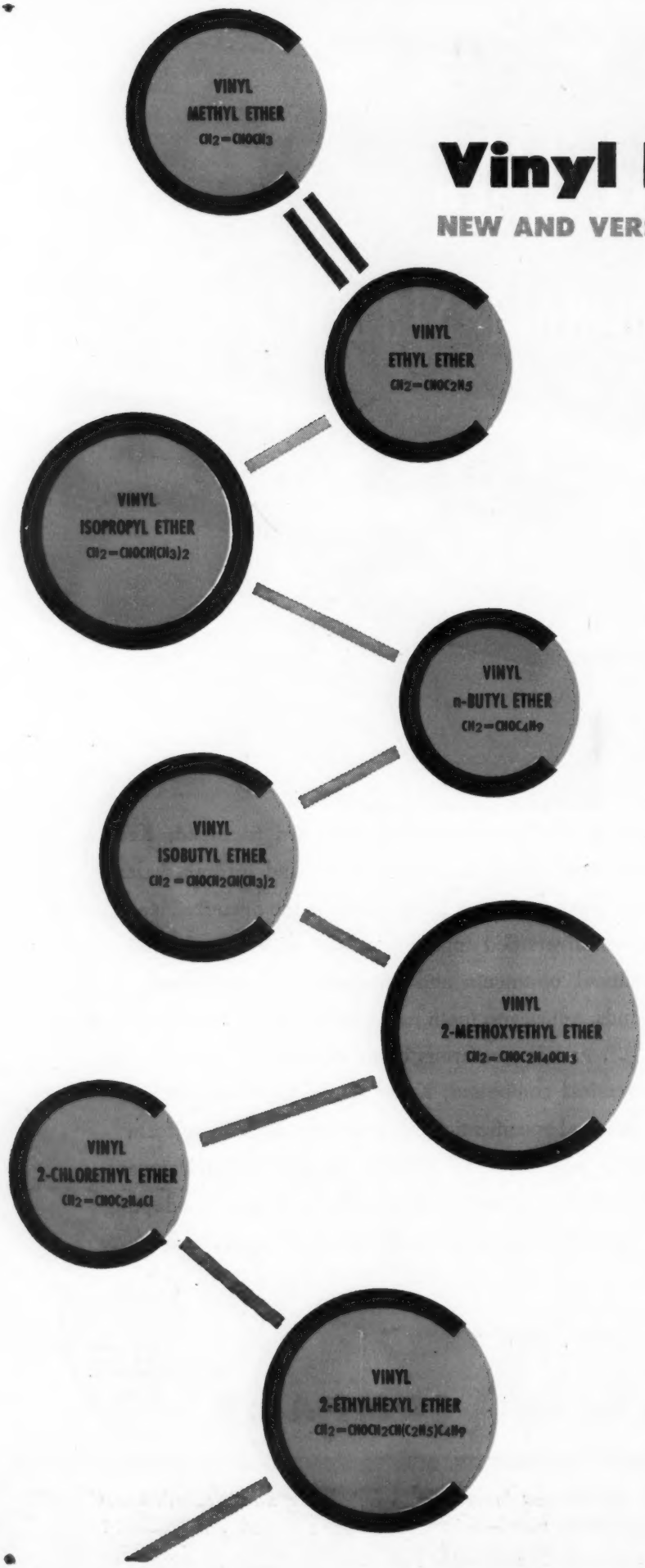

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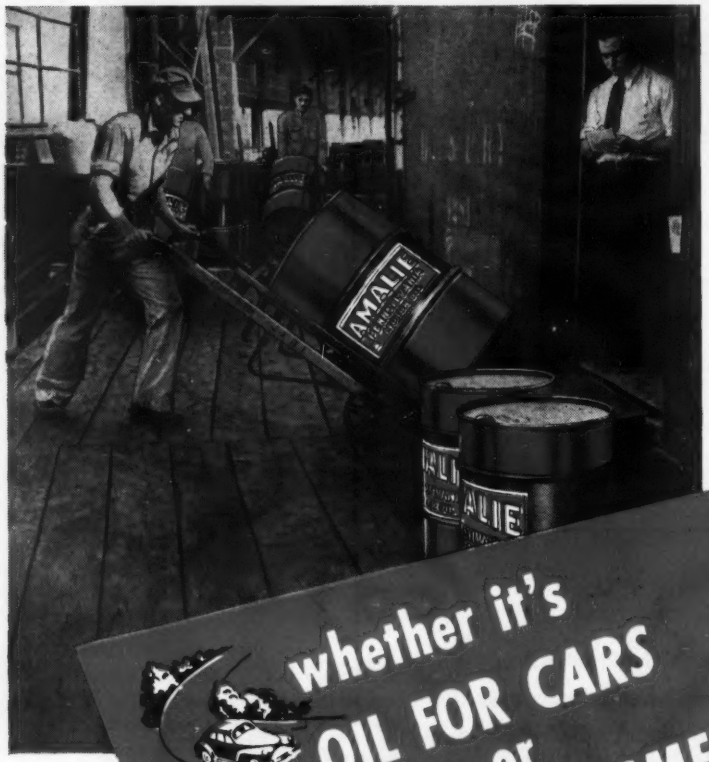

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NEWS OF THE MONTH

BIOS Reports Available

The first of a new series of comprehensive BIOS Overall Reports on German technology is being made available to American businessmen by Great Britain, the Office of Technical Services, Department of Commerce has announced.

The first report, a critical evaluation of the German petroleum and synthetic oil industry, was prepared by a mission from the British Ministry of Fuel and Power. It is based on information obtained by American and British industrial intelligence specialists who investigated German petroleum and synthetic oil processes.

The series of BIOS Overall Reports, according to the British Board of Trade, are surveys of individual German industries and present not only summaries of the reports, but attempt to be at the same time critical appraisals of their subjects. They have been compiled with the object of comparing the state of development of British and German industries—thus providing a standard reference to the outstanding German achievements.

According to the British Commonwealth Scientific Office in Washington, D. C., about 50 BIOS Overall Reports are planned, all of which were expected to be printed by the end of June of this year.

Shell Builds Synthetic Detergents Plant

The first unit in what may become a complete plant for making oil-derived synthetic detergents used in household and industrial soaps, cleansers and emulsifying agents is being constructed by the Shell Chemical Corp. in Wood River, Ill. A subsidiary of Shell Oil Company, Inc., Shell Chemical will process raw materials received from Shell Oil's refinery in Wood River, near St. Louis. The new unit is scheduled to manufacture an intermediate chemical used in making finished detergents.

Chemical Plans For South Africa

Taking advantage of the raw materials supply, including acids, ammonia, and other basic chemicals, a United Kingdom chemicals manufacturer is said to be planning an extensive South African chemical branch plant, which eventually will seek to supply requirements of the markets in Africa, the Middle East, Australia and New Zealand.

According to American official sources, the parent firm, Boots, Ltd., will use by-product materials from the works of African Explosives, at Modderfountein, U. So. Africa, while alcohol, acetone and other solvents will be obtained from still another manufacturer. Creosote and benzol derivatives likewise will be obtained locally.

Masonite Names O'Neil

T. M. O'Neil, previously sales engineer for Heyden Chemical Corp., has joined the Masonite Corp. as manager of its new chemical products division.

Ship Tank Car Of Shale Oil

A railroad tank car of more than 6,000 gallons of crude shale oil—the first bulk shipment of oil from the Bureau of Mines' new oil shale demonstration plant near Rifle, Colo.—is undergoing fractionation by the Universal Oil Products Co. at Riverside, Ill. Subsequently, the Union Oil Co. will conduct cracking and other refining studies in its California laboratories.

Although smaller lots of shale oil have been sent previously to research laboratories, the tank car lot was the first shipment of its kind.

U. S. Committee for Sugar Analysis Formed

The constitution of the International Commission for Uniform Methods of Sugar Analysis provides that any country may affiliate with it through the establishment of a National Committee representing all of the sugar interests of that country, and that affiliated countries may fully participate in the deliberations of the Commission through accredited representatives. In order to comply with this provision, the nucleus of a United States National Committee was recently formed at a meeting in Chicago, and a constitution and by-laws adopted. The following officers were elected: chairman, F. W. Zerban, the New York Sugar Trade Laboratory; vice-chairman, V. Johnson, American Sugar Refining Co.; and secretary-treasurer, C. F. Snyder, National Bureau of Standards.

In order to make the National Committee truly representative of the sugar and allied industries in the United States and its territories, all companies and organizations concerned with uniformity in methods of sugar analysis are cordially invited to join.

British Chemical Firms Cut Prices

Chemical manufacturers in Britain, like those in other fields, have been forced to consider the possibility of cutting prices to meet the Government's call for a stay to inflationary tendencies by voluntary price cutting. Latest important industrial unit to adopt this policy is Imperial Chemical Industries Ltd., whose activities cover every section of the chemical, drug, pharmaceutical, paint and allied industries.

I.C.I. states it is reducing prices over a wide range of products, and the effect of this will be to save customers more than £1,000,000 during the next 12 months.

Koppers, Gulf Plan Fuels Research

The Gulf Oil Corp. and Koppers Co., Inc., have signed an agreement under which the two companies will engage in cooperative research and development of processes for the conversion of coal to gas and liquid fuels.

Both companies have been working for some time independently on matters associated with the production of synthetic liquid fuels. Koppers' research department has developed and patented several improved processes for commercial production of synthesis gas—the raw material used in making synthetic liquid fuels by the Fischer-Tropsch process. Its engineering and construction division is building for the government a $4.5 million Fischer-Tropsch demonstration plant at Louisiana,

The laboratories of the Gulf Research and Development Co. at Harmarville, Pa., and several other Gulf laboratories have been working for some time on various phases of synthetic liquid fuel

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production. Under the new program, Gulf and Koppers may establish joint plant facilities.

Rumford Chemical Appoints Stein

Norman Oscar Stein, formerly general superintendent of the carbon dioxide plants, Air Reduction Sales Co., is now chief technical assistant to the president, Rumford Chemical Works.

Court Orders Reardon Stock Sold

The executor of the estate of J. Vincent Reardon has been directed by the Judge of the Probate Court of St. Louis County, Mo. to accept an offer of Calverton Paint Corp. to purchase a block of shares constituting a majority of the outstanding stock of the Reardon Co., St. Louis.

The Reardon Co. operates five plants at St. Louis, Chicago, Bayonne, N. J., Montreal, Canada, and Los Angeles; and in addition, five warehouses throughout the northwest and south.

The officers of the Calverton Paint Co., Baltimore, Md., advise that no change is contemplated in the management, personnel, policy or operation of company.

The Reardon Co. is endeavoring to have the court give consideration to a subsequent bid by it.

Monsanto Buys Rubber Plant

Monsanto Chemical Co. has purchased a surplus synthetic rubber plant from the WAA for $169,500. The purchase is contingent on approval by the Department of Justice.

The plant, located adjacent to the Monsanto Plastics Division plant in Springfield, Mass. was built by the company for the government during the war. It was originally used for the production of polydichlorostyrene—a plastic material with exceptionally high electrical insulating properties used during the war for radar equipment. Because it does not have a civilian market, manufacture was discontinued soon after the war's end.

The plant was then partially reconverted and materials for synthetic rubber were produced for the Office of Rubber Reserve. When this work was completed, Monsanto leased the plant from the government and began the manufacture of an oil additive which will continue to be the product of the plant.

British Chemical Research Expands

The British chemical industry is devoting an increasing part of its energies to scientific research in the many fields which it covers. This fact was revealed by the more than 80 exhibitors in the chemical section of the 1948 British Industries Fair held in London and Birmingham May 3-14.

Among the goods displayed in the chemical section were heavy chemicals, such as acids, alkalis, and inorganic compounds; fertilizers; coal-tar products; pharmaceuticals; fine chemicals of all types, including the rare earth compounds; solvents; rubber chemicals; water-softening materials; dyestuffs and intermediates for all purposes; pigment colors; pest control products, insecticides and disinfectants, and raw materials for the paint and plastics industries.

Among developments at the Fair this year were the following:

A textiles chemical that makes possible production increases of as much as 10 percent in the spinning of wool and cotton yarns, without extra machinery or labor. A water-dispersed suspension of colloidal silica which gives a considerable increase in fibre drag. This means that less twist can be applied without reduction in yarn strength, the solution acting as a brake on the movement of the shorter fibres. Tensile strength is unimpaired, and more yarn of equal or superior quality can be obtained from the same amount of material.

"Caterole" plant, a new type of thermal catalytic cracking and reforming plant which will produce, for the first time the full range of both olefinic gases and aromatic hydrocarbons, in a very pure state, at one operation. It thus becomes possible to undertake bulk production, from a light non-aromatic petroleum feed, of all those hydrocarbons hitherto derived mainly from coal tar distillation, fermentation, etc.

A fresh development in the war against rust is a solution that is claimed to be the only product which, in one operation, removes rust, prevents its recurrence, and gives a key surface for paint, enamel, and plating. The solution will remove most forms of scale caused by welding or braz-

ONYX IONICS

July INSECTICIDE AND DISINFECTANT EDITION 1948

Effective Dispersing Agent for Wettable Sulfur

NSAE Powder is an anionic wetting agent possessing rapid wetting characteristics in relatively concentrated solution. It has been very successful in the production of insecticides, wettable sulfur and sulfur compounds where its spreading and dispersing properties are particularly valuable. Since it is stable in acid solutions (up to 4% H_2SO_4) it has many special applications as a wetting and dispersing agent.

Resin Dispersions for Use in Insecticides and Fungicides

It is possible that one or more of the Onyx aqueous dispersions of thermoplastic resins—the Xyno Resins—may be of considerable value in enhancing the holding power of insecticides or fungicides on sprayed foliage. We shall be glad to cooperate if you are interested in samples for test purposes.

Onyx Technical Data Sheets of Interest to the Insecticide and Disinfectant Fields

Onyx Technical Data Sheets cover the properties, characteristics and applications of individual Onyx chemical specialties. Of particular interest to the insecticide and disinfectant manufacturer are the data sheets listed below.

IND.-5—*Catiosan* . . . cationic wetting and emulsifying agent.

IND.-4—*Dialkyl Dimethyl Ammonium Bromides* . . . solvent soluble cationic surface-active bactericidal and emulsifying agents.

IND.-3—*Maprofix Paste* . . . dispersing agent for insecticides and fungicides.

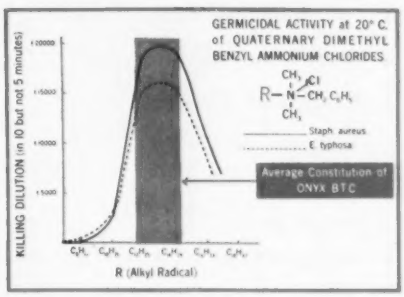
IND.-1—*Neutronyx Series* of non-ionic emulsifying and dispersing agents for insecticides.

IND.-2 — *NSAE Powder* . . . anionic wetting agent for insecticides and fungicides—notably sulfur and sulfur compounds.

Use Non-Toxic BTC for Effective Sanitization and Deodorization

The superiority of cation-active BTC as an efficient bactericide has been thoroughly demonstrated. It is approved and accepted by leading health authorities for all sanitizing purposes. Non-toxic in virtually all use-dilutions, it has an added value not as widely appreciated as it should be. It is a dependable, powerful deodorizing agent.

The active ingredient (50%) of BTC is an alkyl dimethyl benzyl ammonium


GERMICIDAL ACTIVITY at 20° C. of QUATERNARY DIMETHYL BENZYL AMMONIUM CHLORIDES
KILLING DILUTION (in 10 but not 5 minutes)
Staph. aureus
E. typhosa
Average Constitution of ONYX BTC
R (Alkyl Radical)

chloride. The bactericidal properties of this material are chiefly due to its highly essential long alkyl chain. BTC is maintained at maximum effectiveness by strict laboratory and plant control, which consistently holds the alkyl radical within the range at which optimum bactericidal and bacteriostatic action is obtained. BTC contains no mercury compounds, hypochlorites, alkalies, acids, phenol or formaldehyde. The 50% concentrate is freely soluble in water in all proportions, and can easily be made up in 10% solution for ultimate consumer usage.

Aqueous BTC solutions have excellent wetting and penetrating properties. It acts as a speedy, non-selective, surface-active germicide and deodorant. At recommended use-dilutions it is practically colorless, odorless, non-toxic and non-irritating. BTC is compatible with most solvents, except those which are anionic. Corrosive action on most metals and construction materials is negligible.

BTC is in broad general use wherever sanitation is essential . . . in eating and drinking establishments, dairies, milk processing plants, food processing plants, etc. It is being used more and more for deodorization, particularly where putrefactive odors are involved.

Write for complete data.

NEW DEVELOPMENTS

For Further Details Write Onyx

New "Quats" for Research Work. **Onyx can supply samples of the following newly developed quaternaries for laboratory research: 1) Dicetyl Dimethyl Ammonium Bromide; 2) Tricetyl Methyl Ammonium Bromide; and 3) Tetracetyl Ammonium Bromide.**

●

Detergent-Sanitizer Concentrates. **The widespread need for suitable combination agents capable of providing both detergent and sanitization action has led to the development of a number of such materials here at Onyx. If you will let us know what use you might plan to make of such materials, we shall be glad to make specific recommendations as to application and formulation.**

●

Emulsifier for Oil-Based Insecticides. **A mixture of non-ionic Neutronyx 331 and 834 has been found to be highly effective as an emulsifying agent for oil-based insecticides.* This mixture provides a finished insecticide solution to which only water has to be added before use. We'll be glad to discuss full details if you are interested.**

*** *particularly Chlordane and DDT.***

The "Quat" that Specializes on Algae

All quaternaries do *not* make equally effective algaecides. For example, though the alkyl dimethyl ammonium chlorides, typified by BTC, are applicable to the control of algae in swimming pools, cooling water and air conditioning systems, they are nowhere nearly as effective for the purpose as Onyxide 75%. This alkenyl dimethyl ethyl ammonium bromide (75% active material in isopropanol) has been tested and proved to be especially superior as an algaecide to all other commercial quaternaries now available.

If you are interested in marketing an effective algaecide for swimming pools or for similar water-conditioning, please write us for the complete story.

onyx SPECIAL CHEMICALS FOR INDUSTRY

ONYX OIL & CHEMICAL COMPANY
JERSEY CITY 2, N. J.
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In Canada: Onyx Oil & Chemical Co., Ltd., Montreal, Toronto, St. Johns, Que.

Here it is!

SOURCES OF INFORMATION for INDUSTRIAL MARKET RESEARCH

★ **With Special Reference to the Chemical Process Industries**

Edited by
RICHARD M. LAWRENCE

You readers of Chemical Industries asked for this. You wrote us many letters requesting that we reprint our series on information sources for chemical market research and we are glad to be able to announce that the book is now off the press.

The 104-page reprint contains all of the material in the original series: detailed listings of services and publications of the various U. S. and Canadian government departments, state publications, independent trade data sources, also how to classify and interpret chemical market data and other valuable information for persons engaged in market research in the process industries. Use the handy form below to order your copy now.

Please send —— copies of "Sources of Information for Industrial Market Research" at $2.50 each. My remittance is enclosed. (Include 5c per copy sales tax for N. Y. City addresses.)

Name .....

Company .....

Address .....

.....

CHEMICAL INDUSTRIES, 522 5th Ave., New York 18

ing including hot rolled scale. The same manufacturer is also producing a keying solution for aluminum which will remove oxidation, prevent it recurring and act as a binding agent between aluminum and paint.

Chemicals Wanted

The following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Federal and Dearborn Sts., Chicago 16:

Tetrahydroanthracene
3-Methylphenanthrene
2-Methylphenanthrene
Tantalum boride
Potassium chromium thiocyanate
Geranic acid
Sodium trithionate
Zirconium boride
Vanadium boride
Thorium boride
Hafnium
Butyl titanate
2, 5-Diaminotoluene
1, 4-Diaminonaphthalene
1, 4-Diaminocyclohexane
Di-n-butylene triamine
cis-Decahydro-1-naphthol
Scandium
2-Mercapto-1, 3-propanediol
Phloroglucinol

McMillan Receives Morehead Medal

Albert McMillan of Shawinigan Chemicals, Ltd., has been awarded the James Turner Morehead medal for his work in building and operating some of the first major acetylene generating plants.

Mines Pilot Plant Contract Awarded

A contract for engineering, procurement and erection services in the completion of a Fischer-Tropsch (synthetic liquid fuels) pilot plant at Brucetown, Pa., for the Bureau of Mines has been awarded to the chemical plants division of Blaw-Knox Co.

The pilot plant is part of the Bureau's extensive program for the development of information and processes on the production of synthetic liquid fuels from coal. The Bureau's eventual plan in the use of this pilot plant is to process up to 7,500 cubic feet of synthesis gas per hour, from which will be produced up to five barrels per day of crude output.

Freeport Sulphur Elects Shirley

R. K. Shirley, elected executive vice-president of Freeport Sulphur Co. He has been vice-president and treasurer.

CALENDAR *of* EVENTS

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS, annual convention, Sheraton-Bon Air Hotel, Augusta, Ga., Oct. 21-23.

AMERICAN GAS ASSOCIATION, annual convention, Atlantic City, week of Oct. 4.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, regional meeting, French Lick, Indiana, Sept. 15-17.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, regional meeting, Hotel Cortez, El Paso, Oct. 24-27.

AMERICAN PETROLEUM INSTITUTE, lubrication committee, Hotel Traymore, Atlantic City, Sept. 16-18.

ASSOCIATION OF CONSULTING CHEMISTS AND CHEMICAL ENGINEERS, INC., annual meeting, Hotel Sheraton, N. Y.C., Oct. 26.

ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS, INC., annual meeting, Shoreham Hotel, Washington, D. C., Oct. 11-13.

COMPRESSED GAS MANUFACTURERS ASSOCIATION, INC., annual meeting, Canadian Section, Murray Bay, Quebec, Sept. 9-11.

THE ELECTROCHEMICAL SOCIETY, INC., semi-annual convention, Hotel Pennsylvania, N. Y. C., Oct. 13-16.

THE INSTRUMENT SOCIETY OF AMERICA, Third Instrument Conference and Exhibit, Philadelphia Convention Hall, Sept. 13-17.

NATION CHEMICAL EXPOSITION, Coliseum, Chicago, Oct. 12-16.

NORTHEASTERN WOOD UTILIZATION COUNCIL, conference on chemistry and utilization of Beck, Cambridge, Mass., Sept. 17.

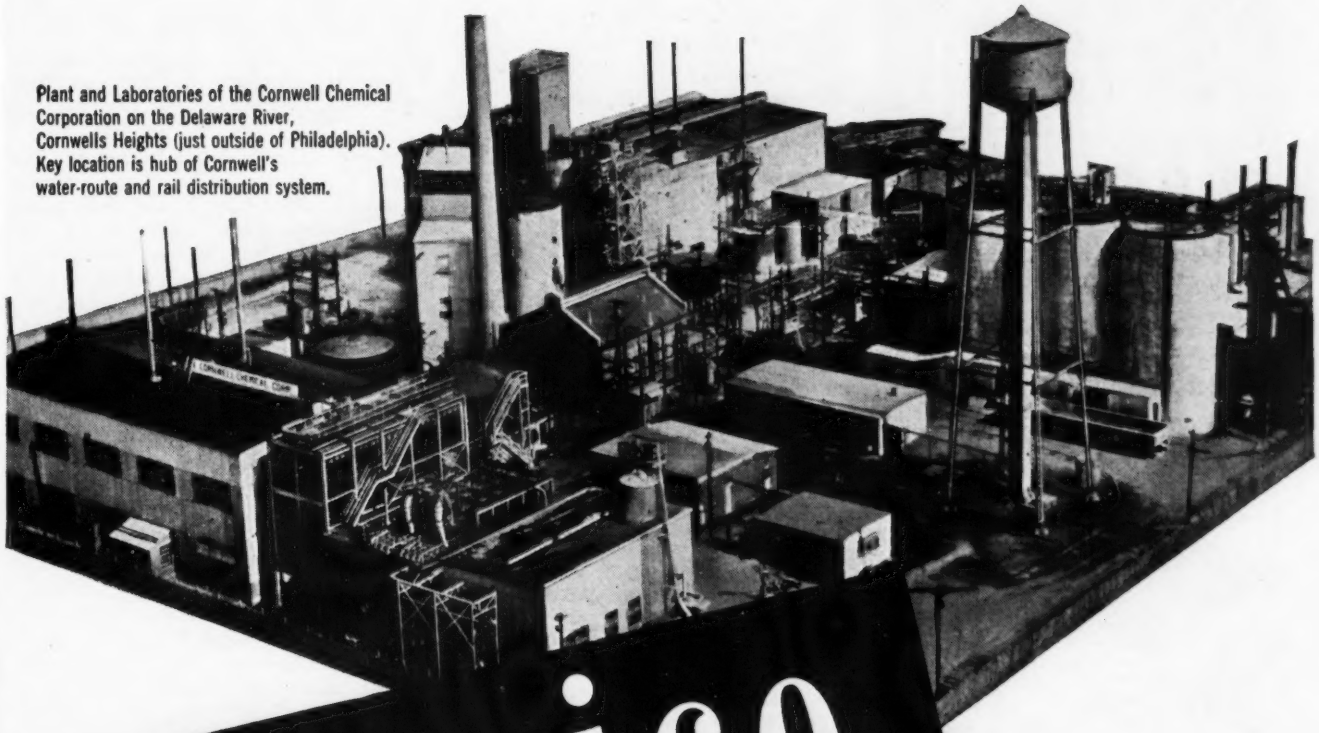
PACKAGING MACHINERY MANUFACTURERS INSTITUTE, annual meeting, Hotel Commodore, N. Y. C., Oct. 11-12.

PORCELAIN ENAMEL INSTITUTE, 10th annual forum, University of Illinois, Urbana, Oct. 13-15.

THIRD NATIONAL PLASTICS EXPOSITION, Grand Central Palace, N. Y. C., Sept. 27-Oct. 2.

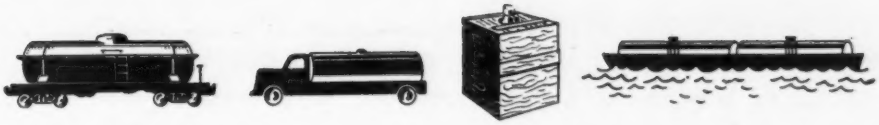
Training Conference

A five-day training conference in Industrial Experimentation will be offered by the Engineering School of Columbia University, New York, September 14-18, 1948. The course is intended to provide both formal and practical insight into fundamentally effective techniques for per-



Plant and Laboratories of the Cornwell Chemical Corporation on the Delaware River, Cornwells Heights (just outside of Philadelphia). Key location is hub of Cornwell's water-route and rail distribution system.

service



SULPHURIC ACID
60° 66° 98% 100%

ELECTROLYTE ACID
—from 1.225 Sp. G. to 1.835 Sp. G.

MURIATIC ACID
18° 20° 22°

NITRIC ACID
36° 38° 40° 42°

MIXED ACID—any strength

ANHYDROUS SODIUM SULPHATE

SALT CAKE
(Sodium Sulphate)

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ALUMINUM CHLORIDE 32°

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PLAN TO ATTEND

CHICAGO COLISEUM

•

NATIONAL CHEMICAL EXPOSITION

•

OCTOBER 12 · 13 · 14 · 15 · 16 1948

sons with a background of experience and at least one course in statistics, quality control, or the equivalent.

Ziegler Names Hillers Technical Director

Carl E. Hillers, appointed technical director of G. S. Ziegler and Co. Upon joining the company as a consultant about a year ago, he set up a research division.

CSA Golf Dates

The golf dates for the Chemical Salesmens Association have been set as follows:

Wednesday, August 18th—Pomonok Golf Club, Flushing, N. Y.

Wednesday, September 15th—Montclair Golf Club, Montclair, N. J.

COMPANIES

Construction of a new two-story and basement administration and research center for CINCINNATI CHEMICAL WORKS, INC., manufacturers of dyes and organic chemicals, Cincinnati, has been started by the Austin Co., engineers and builders. The project marks the first step in the development of a newly acquired 43-acre tract.

The plant of Societe Misr pour la Rayonne S. A. E. located at Kafr-el-Dawar, near Alexandria, Egypt and built by OSCAR KOHORN & CO., LTD. will soon go into production. The factory will produce 5,000,000 lbs. of filament rayon, 5,000,000 lbs. of staple fiber and 1,000,000 lbs. of cellophane annually. This project, conceived in 1936, is the largest American program in Egypt.

Work on the new talc grinding plant being built by the GOUVERNEUR TALC CO., a subsidiary of the R. T. VANDERBILT CO. of New York, is being pushed through and it is expected to be operating about August 1st.

Special grinding equipment will be used and some grades will be made with a particle size of about one micron and a color brightness standard of over 90, which can be used where special whiteness is desired. One of the new features of the plant layout is the use of large cement bins or silos for storing finished products and ore in process.

Construction work on STANOLIND OIL AND GAS CO.'s hydrocarbon synthesis plant at Garden City, Kansas to be called the "Stanosyn Plant" began July 1. Included in the work will be the grading, fencing, draining, and, leveling of sites for processing units and buildings, providing water and power for construction, installing railroad tracks, erection of temporary buildings and construction of some permanent buildings.

The schedule for construction work on the three major plant units will be announced in the near future. These units include the oxygen plant, the synthesis unit, and the chemical refining plant.

Construction has started on a $900,000 expansion program at the HILTON-DAVIS CHEMICAL CO. at Cincinnati. The H. K. Ferguson Co., industrial engineers and builders are in charge of the project.

This expansion in building and equipment will increase the quantity of the items now made and add to the present production of colors, dyes, and intermediates, which are used in the protective film, printing ink, linoleum, and pharmaceutical industries.

Aelion Joins P.I.B.

Rene Aelion, French scientist, newly appointed by the Polytechnic Institute of Brooklyn to carry out a project to convert known chemicals to uses in the plastics field.

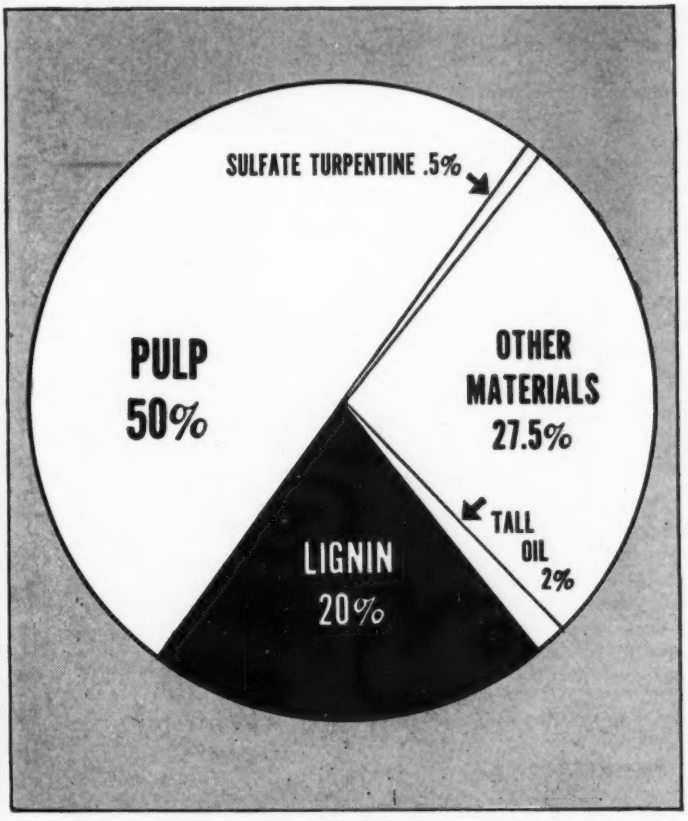
Chemical plants division of BLAW-KNOX CO. has received a contract from SOY-RICH PRODUCTS, INC., for the construction of a 75-ton per day soybean solvent extraction plant at Wichita, Kansas.

Soy-Rich will use part of the meal product in the manufacture of mixed-feeds and will sell the soybean oil in crude form.

The award to Blaw-Knox represents a "turnkey" project, including engineering,

2,000,000 tons

OF SULFATE LIGNIN ARE POTENTIALLY AVAILABLE PER YEAR FROM THE KRAFT PAPER INDUSTRY



AVAILABILITY of recoverable Lignin from Pine Wood (dry basis)

● With such a potential source of lignin from the kraft paper industry, renewed interest is being shown in lignin as a raw material for the chemical industry. Prior to the introduction of INDULIN, the lignin recoverable from the black liquor of the sulphate pulp process has varied widely in composition and properties. This variability in the character of sulfate lignin has greatly retarded its commercial uses.

INDULIN (reproducible grades of sulfate lignin) is offered to investigators in two uniform grades—INDULIN "A" and INDULIN "C" (a disodium salt of type "A"). Our Development Department has a wealth of material on the potential uses for INDULIN.

Write today for further information stating in detail your production process.

industrial CHEMICAL SALES

division west virginia pulp and paper company

New York Central Building 230 Park Ave. New York 17, N. Y.	Leader Building 526 Superior Ave., N. W. Cleveland 14, Ohio	Pure Oil Building 35 E. Wacker Drive Chicago 1, Ill.	Public Ledger Building Independence Square Philadelphia 6, Pa.

LIST OF PRODUCTS

Snow Top Precipitated Calcium Carbonate Tallex Abietic Acid Nuchar Activated Carbons Liquid Caustic Soda Chlorine Liqro Crude Tall Oil Indusoil Distilled Tall Oil Pitch Sulfate Wood Turpentine Polycel Cellulose Fibers

PLAN TO ATTEND

CHICAGO COLISEUM

NATIONAL CHEMICAL EXPOSITION

OCTOBER 12 · 13 · 14 · 15 · 16 1948

procurement and erection of the building and all equipment. The facilities will include a new type of solvent extractor recently developed by the contractor, as well as the Lewis flaking mill and the Blaw-Knox vapor desolventizer.

Completion of a new plant at Trenton, Mich., for manufacture of Sterox AW and Detergent MXP, which are new non-ionic controlled suds detergents, has been announced by MONSANTO CHEMICAL CO.

The demand for these new type detergents, which were introduced in 1947, has been supplied since that time by an interim production unit at Monsanto's Anniston, Ala., plant. The Trenton plant will enable Monsanto to meet an increasing demand for the products.

The DAVISON CHEMICAL CORP. has announced plans for the construction of an addition to its phosphate recover facilities at its phosphate rock mine, near the city of Bartow, Florida, to cost in excess of $500,000. Present plans call for operation of the new unit by January 1, 1949. The unit includes a flotation concentrates plant, utilizing the most recent technical developments to recover very fine sized phosphate rock and, thereby, substantially increasing both the productive capacity and efficiency of the existing facilities.

PHILADELPHIA QUARTZ CO., manufacturers of silicates of soda, has announced the removal of its general offices from 121 South Third St., Philadelphia, where they have been located for almost a half century. The new offices will be in the Public Ledger Building, Independence Square, Philadelphia. The company is to occupy the office space on the eleventh floor of the building.

ABBOTT LABORATORIES has awarded two research grants to the College of Medicine, University of Illinois, to support investigations under the direction of Dr. Milan V. Novak, head of the department of bacteriology and public health.

PERSONNEL

Company Officers

• J. E. Carter, federal tax counsel for THE B. F. GOODRICH CO. has been named assistant secretary.

• Everett W. Price has been appointed to the board of directors of the WOBURN CHEMICAL CORP. of Kearny, New Jersey and WOBURN DEGREASING CO. of Woburn, Mass.

• Horace C. Flanigan of New York City, has been elected a member of the board of directors of GENERAL ANILINE & FILM CORP.

• The board of directors of THE DOW CHEMICAL CO. has named five new members. The new appointees are A. P. Beutel, general manager of the company's Texas Division and an assistant secretary; C. A. Campbell, the company's general counsel; R. L. Curtis, general manager of Dow's Great Western Division; C. A. Gerstacker, a member of the finance committee, and N. D. Griswold, an assistant general manager of the Texas Division.

Diamond Alkali Names Forsyth

James C. Forsyth, appointed manager, branch office sales, for Diamond Alkali Co. He has been supervisor of dairy industry sales.

• Edwin M. Shultes III, of Albany, N. Y. has been named counsel for the Chemical Department of the GENERAL ELECTRIC CO. He succeeds A. Cohen who will continue as patent counsel for the Chemical Department with headquarters in Schenectady.

• Charles E. Lawall, assistant vice president and engineer of coal properties of the Chesapeake and Ohio Railway Co., has been appointed permanent chairman of the Mining Development Committee of BITUMINOUS COAL RESEARCH, INC., and James B. Morrow has been named president of the organization.

Production

• Warren K. Venatta has been appointed manager of product control by ORONITE CHEMICAL CO., subsidiary of Standard Oil Co. of California. In his new position, he will coordinate production availability with requirements.

• G. FELSENTHAL & SONS, INC., Chicago, has appointed Robert M. Gubbins to the position of plant superintendent. He will have complete charge of plant manufacturing operations.

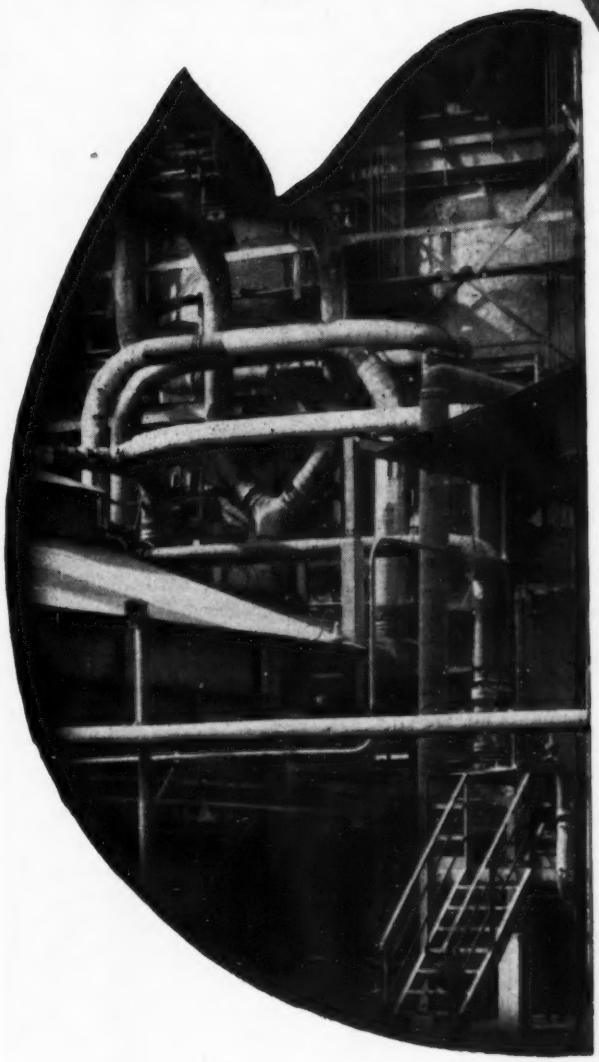
• Harold J. Edmon has been named manager of Naugatuck Aromatics division, UNITED STATES RUBBER CO. He succeeds M. G. Couderchet, who is returning to the staff of Bruno Court, Grasse, France, as sales manager.

• Ernest R. Cathcart, veteran manager of the DU PONT coated fabrics plant at Fairfield, Conn., has been named staff advisor to the company's Fabrics Division management.

Copper Chloride for Gasoline Sweetening

available in 3 types

2 H_2O Crystal
Dried 1½ H_2O Crystal
Anhydrous



Immediately Available from Stocks

For your gasoline sweetening process, specify Harshaw Copper (Cupric) Chloride. The long list of satisfied refineries using Harshaw Copper Chloride is in itself a recommendation of this highly efficient material.

Three types are available . . .

Copper Chloride 2 H_2O Crystal — 35.8% Cu (Typical)

Copper Chloride 1½ H_2O Dried Crystal — 39.6% Cu (Typical)

Copper Chloride Anhydrous — 46.5% Cu (Typical) . . .

Choose the one best suited to your needs.

All are immediately available from conveniently located stocks. Contact the Harshaw branch office nearest to you for your requirements.

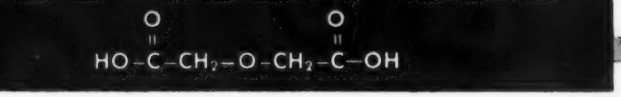
CHICAGO • CINCINNATI • DETROIT • HOUSTON
LOS ANGELES • PHILADELPHIA • PITTSBURGH • NEW YORK

THE HARSHAW CHEMICAL CO.
1945 East 97th Street, Cleveland 6, Ohio
BRANCHES IN PRINCIPAL CITIES

NEW DUPONT DIBASIC ACID

A high purity intermediate with interesting possibilities for plasticizers, resins, and other applications.

DIGLYCOLIC ACID



PHYSICAL PROPERTIES of Pure Diglycolic Acid*

Molecular Weight:	134.1
Physical Appearance:	White crystalline solid
Melting Point:	148° C.
Boiling Point:	Decomposes
Ionization Constant; 25° C.:	$k_1 = 1.1 \times 10^{-3}$ $k_2 = 3.7 \times 10^{-5}$
Solubility in Water:	20.9 g. per 100 g. H_2O at 0° C. 71.5 g. per 100 g. H_2O at 25° C.
pH of 10% Aqueous Solution at 25° C.:	1.4

*The commercial acid is 98+% pure by titration.

CHEMICAL PROPERTIES

★ Reacts typically to form acid and neutral salts: esterifies readily.

★ Reacts with ammonia to form either the amide or the cyclic imide.

★ Dehydrates readily to the cyclic anhydride in the presence of acetyl chloride or acetic anhydride.

★ Forms a polymeric anhydride on prolonged heating above the melting point.

NOW AVAILABLE IN COMMERCIAL QUANTITIES . . . . . Packaged in 50-lb. multi-wall paper bags.

WRITE TODAY for free sample . . . technical information . . . and prices.

DU PONT
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AMMONIA DEPARTMENT

BETTER THINGS FOR BETTER LIVING
. . THROUGH CHEMISTRY

E. I. DU PONT DE NEMOURS & CO. (INC.) • WILMINGTON 98, DELAWARE

American Optical Elects Barnes

R. Bowling Barnes, named vice-president in charge of research and development of American Optical Co. For the past 12 years he has been director of the physics division, Stamford Research Laboratories, American Cyanamid Co.

Sales

• Charles W. Mackett has been named manager of sales operations for the Hewitt Rubber Division, HEWITT-ROBINS, INC.

• Two young men have been appointed to key posts, one in sales and the other in manufacturing, by the VIRGINIA SMELTING Co. They are W. F. Luckenbach, Jr., who becomes manager of industrial sales, and Daniel W. Duncan, who is named head of the company's chemical engineering process improvement section. Luckenbach is 35 and Duncan 32.

• Two ANSCO sales department executives have been promoted to regional managerships.

William Balch, in addition to his post as New York district manager, becomes Eastern sales manager. Harold A. Edlund, Chicago district manager, becomes Western sales manager, in addition to his present position.

Research

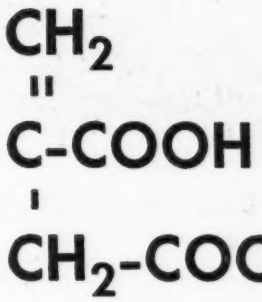
• C. P. Neidig has joined the Chemical Products Division of ATLANTIC REFINING Co. He will be in charge of market research.

• Three scientists at the Richmond Laboratories of CALIFORNIA RESEARCH CORP., a Standard of California subsidiary, have been designated as "research associates" in recognition of their technical achievements. They are, John Y. Beach, James O. Clayton and Ronald T. Macdonald.

• Winston L. Hole has been named assistant to the director of the OHIO STATE UNIVERSITY RESEARCH FOUNDATION.

• John H. Sachs, manager of the development division of DU PONT's Organic

ITACONIC ACID



Now Available From Our Pilot Plant For Larger Scale Investigations Or Customer Acceptance Tests.

This unsaturated dibasic acid has shown promise as a raw material for the preparation of resins of alkyd and other types, for the preparation of surface-active agents, and in chemical synthesis.

Its esters can be polymerized alone or co-polymerized with other monomers to produce resinous materials of widely varying characteristics.

We will be very pleased to quote prices on request

Chas. PFIZER & Co., Inc.

Manufacturing Chemists Since 1849

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THREE ELEPHANT
BORAX
and
BORIC ACID

TRONA BROMINE
Muriate and Sulphate of POTASH
REFINED POTASSIUM CHLORIDE
SODA ASH • SALT CAKE
LITHIUM CONCENTRATES

AMERICAN POTASH & CHEMICAL CORPORATION
122 EAST 42nd STREET • • • NEW YORK 17, N. Y.
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609 S. GRAND AVENUE LOS ANGELES 14, CALIF.

MANUFACTURING CHEMISTS

DIPHENYL-
HYDANTOINE-
SODIUM USP

BENZONAPHTHOL

LAMEX CHEMICAL CORP.
Makers of Fine Chemicals and Pharmaceuticals
15 SPRUCE STREET • NEW YORK 7, N. Y.
Worth 2-2223

Chemicals Department, has retired from the company. In 1917, Dr. Sachs joined the company as a research chemist.

NEWS *of* SUPPLIERS

H. W. North Co., Erie, Pennsylvania, manufacturing engineers and designers of mixing and processing machinery, has appointed D. W. DuVall, Eastern sales manager.

Reuben H. Brown is retiring as manager of the New Orleans plant of **Bemis Bro. Bag Co.** He has agreed, however, to continue with the company for several years more as special representative.

Clyde H. Irwin has been assigned as field engineer in charge of the Pittsburgh office of **Infilco Inc.,** Chicago manufacturers of water purification, sewage and waste treating equipment.

Norman Evans has been elected vice-president of the **Pressed Steel Tank Co.,** Milwaukee, Wisconsin.

R. F. Miller has been appointed assistant to vice president, Research and Technology Department, **Carnegie-Illinois Steel Corp.**

Sublimation

(*Continued from page* 38)

cylic acid is sublimed in this manner with air containing 6 per cent CO_2.

Entrainer sublimation may be carried out on a continuous basis by passing the solid in granular form through the vaporizer on a screen conveyor. The entrainer gas passes up through the solid and on to the condenser. This type of operation is somewhat analogous to through-circulation drying of solids.

An interesting process for continuous sublimation of salicylic acid with air is described in a patent to the Monsanto Chemical Co.[8] As shown in Fig. 2(d), the pulverized charge is fed to a mill by a screw conveyor. The solid in the form of a finely ground powder from the mill is suspended in the entrainer gas and conveyed to a series of separators for removal of unvaporized solids. Rapid vaporization of the acid into the entrainer is achieved as a result of the extended surface offered by the finely ground solid. The gases pass through a filter for final removal of solids and go to the condenser for product recovery.

AUXILIARY EQUIPMENT

Mechanical oil or mercury diffusion pumps may be used for vacuum. Condensers and cold traps are used to prevent traces of sublimate from reaching the vacuum pumps. Steam ejectors are useful for large scale operations, particularly when process steam is available.

Solids handling equipment may include belt and screw conveyors for continuous operation.

Cyclone separators may be employed

[8] See U. S. Pat. 1,987,301, Jan. 5, 1935.

PURCHASE ORDER

XYZ PHARMACEUTICAL COMPANY

126 CHESTNUT STREET
FORT WAYNE, INDIANA

To: Merck and Co., Inc.
Rahway, New Jersey

Date: 2/19/48
Req. By:
Using Dep't: Production
Terms: 1/10 EOM, n/30 EO
F. O. B. Our Warehouse
Ship or Deliver To Our Warehouse

Delivery Desired: At Once

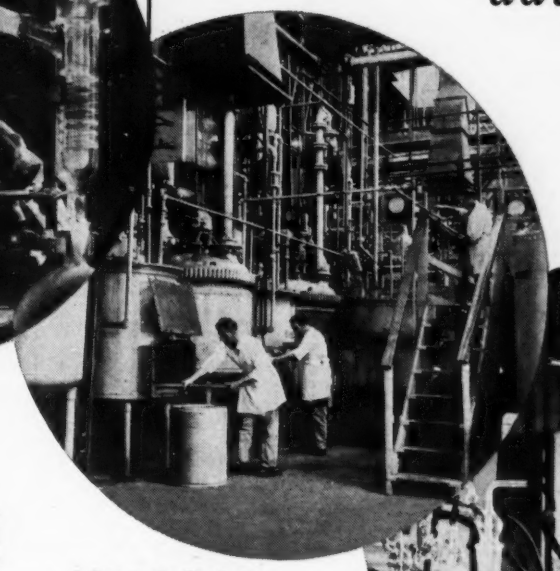
Furnish The Following Subject To All Conditions On Reverse Side:

QUANTITY	DESCRIPTION	OUR CODE #	UNIT PRICE	TOTAL
	Thiamine Hydrochloride			
	Riboflavin			
	Niacin			
	B1			

With Your Order For MERCK VITAMINS

you are buying definite advantages for your own products.

Distillation Procedure in Vitamin Production



A Step in the Production of Vitamin B_1

Chemical Assay for Vitamin K

MERCK research has been directly responsible for many important original contributions to the synthesis, development, and large-scale production of pure vitamins and vitamin factors.

MERCK experience in the production of vitamins extends from the original synthesis of the first pure vitamin down through the recent isolation of Vitamin B_{12} in The Merck Research Laboratories.

Vitamins of unvarying high quality and purity are produced under the Merck label. Their established reputation can become part of your own vitamin products.

The following MERCK VITAMINS are available:

Thiamine Hydrochloride
Riboflavin
Niacin
Niacinamide
Niacinamide Hydrochloride
Pyridoxine Hydrochloride
Calcium Pantothenate Dextrorotatory
Biotin
Ascorbic Acid
Menadione (Vitamin K Active)
Vitamin K_1
Alpha Tocopherol
Alpha Tocopherol Acetate

★ ★ ★

Choline

We will be pleased to quote on your requirements.

MERCK VITAMINS

MERCK & CO., Inc. RAHWAY, N. J.

Manufacturing Chemists

ARAPAHOE
TRADE-MARK

WHAT WE HAVE DONE FOR OTHERS

During The Past Year We Have Request — Produced:

- **Zerewitinoff Reagent (MeMgI)**
- **VitaStain (Tri. Tet. Chl.)**
- **Girard's Reagents ("P" and "T")**
- **Ethylene Glycol Dimethyl Ether**
- **N-Bromosuccinimide**
- **B-2-Thienylalanine**

All of these, now regularly available from us, cost their original customers less today! We also can, and will custom manufacture for your EXCLUSIVE use in pilot or commercial volume.

We have The Modern Plant And Capital—
We Have Or Can Obtain The Special Equipment—
We Can Increase our EXPERIENCED STAFF, When Necessary To Solve Your Special Product Problems!

WE CAN DO FOR YOU — INQUIRE!

For name of our nearest representative write to Dept. "A"

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PRODUCERS OF FINE ORGANIC CHEMICALS

Massco Grigsby
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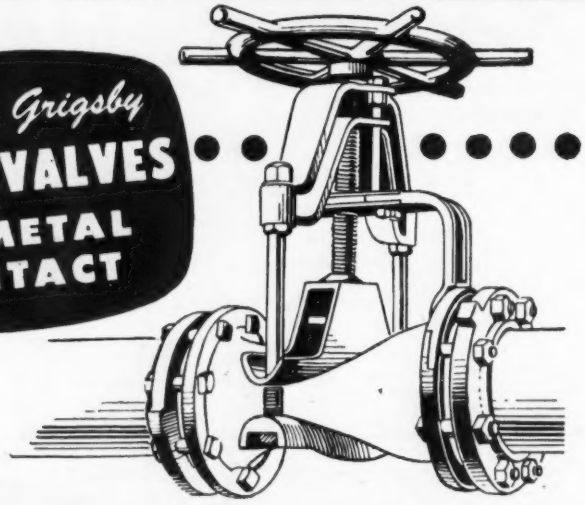

Recommended for transporting abrasive and/or corrosive pulps and liquids, where severe wear makes replacement of metal valves too costly. Rubber or synthetic sleeve closes tight even on solid particles. No packing glands; not affected by freezing or scale formation. Sizes: 1", 2", 3", 4", 6", 8", 10" and 12" dia.

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to prevent dust in entrainer gas exhaust from reaching the atmosphere. Bag filters or scrubbing towers may be required in extreme cases, particularly if the materials escaping present a health hazard.

NEEDS AND THE FUTURE

Descriptive data on sublimation equipment and plant performance are meager, and there have been few new developments. Much is needed in the way of the fundamental data and correlations necessary for accurate design of sublimation equipment. Further generalization of the principles of condenser design and performance is especially needed.

Sublimation under high vacuum analogous to molecular distillation and sublimation drying appear to be promising directions for new developments. Further application of high frequency electric heating should be useful in high temperature metallurgical processes and for drying of certain materials.

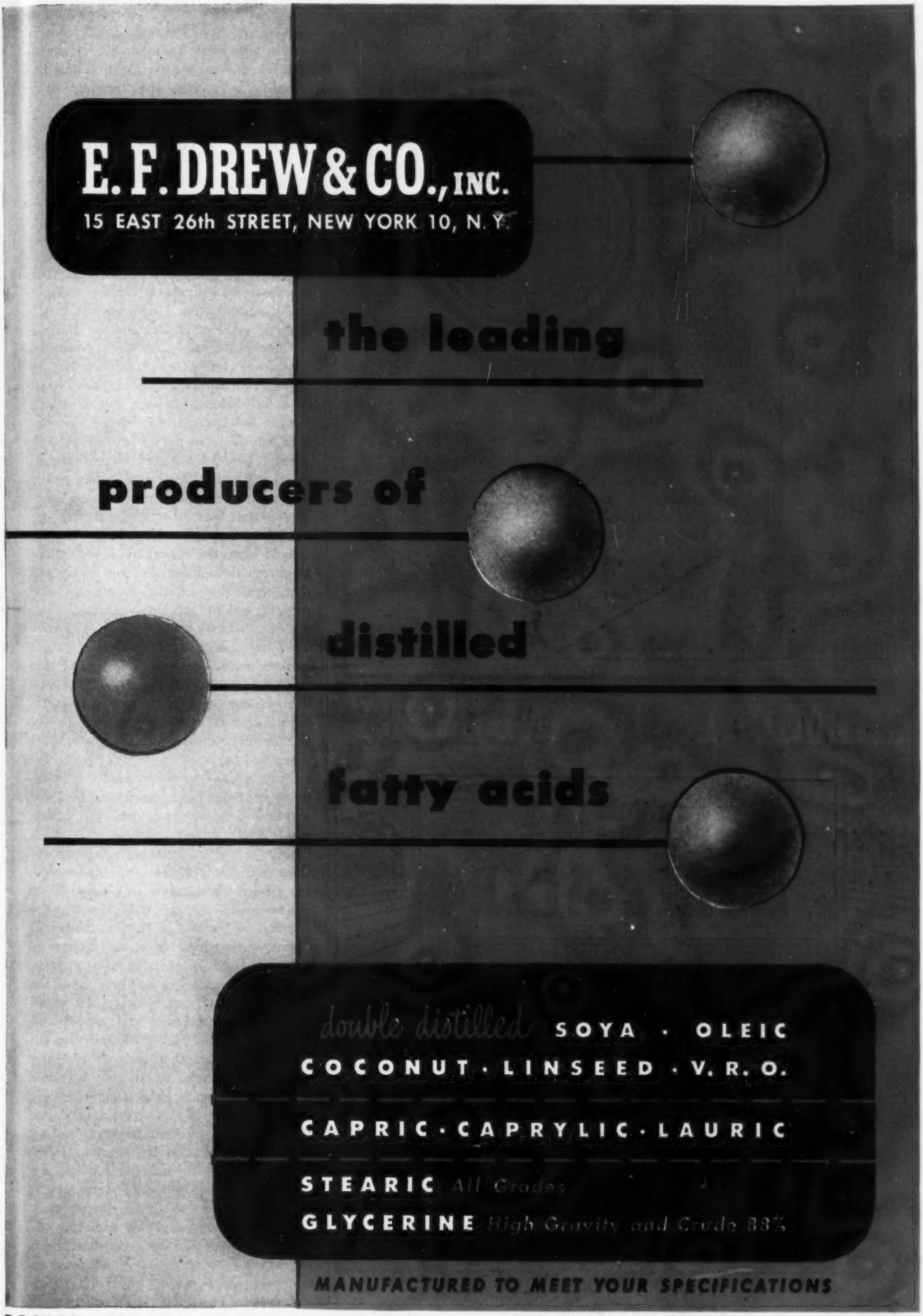
Development of sublimation along unit operational lines has not kept pace with other separation processes, such as distillation, absorption and drying. A shift in the future toward greater application of inorganic chemical processing might make the further development of sublimation as a unit operation particularly necessary and worthwhile.

Acknowledgment: The helpful suggestions of T. M. H. Taylor of the Cutter Laboratories, Berkeley, California, in the preparation of this article are gratefully acknowledged.

Packaging & Shipping

(*Continued from page 96*)

are reviewed here that should be observed in the handling of this chemical in rail or truck transportation and in storage. It is recommended that the material should not be loaded or stored under any conditions where it may be in close contact or become incorporated with any explosives or readily combustible materials in quantity. It is important to avoid fires which may involve the material. If, however, the chemical should become involved in a fire, it is advisable to drench it with large quantities of water and this should be done as soon as possible after there is any indication of fire. If the fire is in a freight car or storage building, it is desirable to supply as much ventilation as possible by opening doors or other means of ventilation since ammonium nitrate is inherently an oxidizing material and fires in which it is involved are not dependent on atmospheric oxygen for progress of combustion. Confinement of the burning material and the products of combustion is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undesirable and should be avoided. In the event that the fire should attain proportions that would make preservation of the car or storage building improbable, it is advisable to confine activity to the wetting of surroundings and the removal of adjacent cars or other mobile equipment. Precautions should be observed to avoid breathing the fumes from such a fire by taking a position remote from the fumes or by the use of suitable protective breathing equipment.

During the year regulations were made effective by the ICC to govern transportation of radio-active materials. The headquarters and the laboratory staffs of the Bureau conferred with experts in the field of nuclear physics for the purpose of determining the necessary precautions to assure safety in transportation of radio-active substances, and as a result of these conferences, were able to submit recommended regulations to the Commission which were approved and promulgated. The quantity of these materials moving in rail express service has greatly increased in the past few years and new commercial uses of the substances are constantly being developed. It is considered that the adoption of regulations to govern these shipments was timely and that observance of the regulations will prevent serious accidents.

Published statistics show that during 1947 the production of dangerous articles was maintained at a high level and that there was a marked increase in the production of most such commodities. It has been estimated that the increase in the volume of liquified petroleum gas sold for domestic purposes in 1947 over the amount sold in 1946 exceeded the industry's total sales for domestic use in 1941, and due to shortages of production, equipment and shipping containers, it is known that there is a large demand for this material which has not been satisfied. In spite of the increase in production of nearly all dangerous articles, with the addition of several types of dangerous commodities which have not heretofore been produced in commercial quantities, the total property loss resulting from the transportation of dangerous articles of all classes was well below that reported in any year since 1941. Of particular interest is the fact that the loss resulting from the transportation of corrosive liquids and acids was approximately $32,200 compared with a property loss of $55,800 in the previous year.

There continues to be a serious shortage of materials for containers which are suitable for dangerous articles, making it necessary in the interest of the economy of the country to continue containers in service which would otherwise have been retired and to authorize containers on relatively short notice without the advantage of as complete an investigation of their suitability as would normally be

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conducted. It is considered that the record which has been established in spite of increasing production and container shortages speaks well for the results which can be obtained by coordinated and cooperative efforts of shippers, carriers and container manufacturers, without imposing undue hardships on any of the parties interested nor seriously hampering the economic welfare of the country.

Inspectors of the Bureau have continued to make frequent inspections of railroad yards and freight houses and have conferred with shippers in order that all concerned will be thoroughly familiar with the requirements of the regulations which apply to them. The Summary on Page 1 of this report indicates the routine activities of the inspectors for the years 1946 and 1947. In addition to these routine activities, a large part of the inspectors' time must necessarily be devoted to the investigation of accidents and to the instruction of persons connected with the transportation industry as well as shippers. It is considered that the efforts devoted to the education of shippers are largely responsible for the safety record which has been maintained through the years.

In a table listing the accidents which occurred in connection with the transportation of explosives which resulted in fires and explosions during the year, it may be noted that there were no persons killed or injured by Class A, B, or C Explosives and that the only two injuries reported resulted from the illegal shipment of loaded firearms by rail express. The total property loss resulting from fires or explosions in these shipments was only $40, $39 of which is chargeable to fireworks.

During the year 302 amendments to the regulations for the transportation of explosives and other dangerous articles were submitted to the ICC and were approved and published. A majority of these amendments were necessitated by continued emergency conditions or the development of new chemicals which are properly classed as dangerous articles.

"We have received the hearty cooperation of the ICC, the U. S. Coast Guard and the Board of Transport Commissioners for Canada, and their assistance is deeply appreciated. The continued valued assistance of the Institute of Makers of Explosives, The Manufacturing Chemists' Association, the Compressed Gas Manufacturers' Association, the Agricultural Fungicide Association, the Chlorine Institute and the American Petroleum Institute is gratefully acknowledged. The excellent record again established is a great credit to the rail and express carriers and to the shippers of explosives and other dangerous articles. The cooperation of these organizations and the individual shippers and manufacturers is most gratifying."

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CHEMICAL SPECIALTIES

A department devoted to news of the chemical specialties field. Descriptions of new specialty products will be found in the New Products & Processes department.

Sherwin-Williams Producing Benzene Hex

The Sherwin-Williams Co. has begun commercial production of benzene hexachloride. To be sold under the trade name of Iso-Hex, the material is effective against a wide variety of insects and kills as a vapor and as a stomach and contact poison. It can be combined with DDT and chlorinated camphene to give better control of some pests than when used alone. It is compatible with all commonly used insect and fungi killers, except those of a highly alkaline reaction. It kills insect nymphs, eggs and embryos as well as adults. Used as a soil treatment, it vaporizes so slowly that its effectiveness lasts over a long period of time. The Sherwin-Williams product will be sold as a wettable powder dust, containing 6% gamma isomer.

Anti-skid Material In New Rug

Wollner-Clist, Inc., has incorporated U. S. Rubber Co.'s Rugback into its new rug. The company reports an economical process for roller-coating the anti-skid material onto the back of the rug at the time of manufacture. The anti-skid backing also anchors the rug tufts and is waterproof, making the rug thoroughly washable, as proved by tests in two consumer laboratories.

Rugback is a liquid rubber product which is also available for home application to deskid any rug. It dries quickly to form a colorless film which prevents slipping without sticking the rug to the floor.

DDT Cow Bomb

A DDT bomb for controlling flies and lice on cattle and other farm animals is being manufactured by the Edco Corp., Elkton, Md., for exclusive distribution by Innis, Speiden & Co., New York City. Called Mul-T-Vapor cow bomb, it is claimed to protect cattle from flies for three weeks with a half-minute spraying at a cost of only one-third cent a head per day.

The bomb contains 10% DDT in a special solvent which drives the moist DDT particles clear to the hide, leaving tiny crystals the full length of every hair. The solvents evaporate rapidly, leaving a dry deposit on hair and hide which will not wash off in a heavy rain. The sprayed animal, the distributors say, immediately becomes a walking fly killer.

Price of the bomb is $7.50 apiece or $7 in lots of six. There is a shell deposit, which is returnable, of $3.50. The bombs are refillable. The sturdy shipping case of 6 bombs shipped to dealers carries a returnable deposit of $4.00.

Boyle-Midway Offers New Ant Spray

Boyle-Midway, Inc., New York, maker of Black Flag insecticides, is marketing a new ant spray called "Antrol." The incorporation of chlordane into the new formulation makes it very effective against ants and roaches. It is unique in that it is the first nationally distributed ant spray to contain chlordane in a water base. This absence of solvents make the material safe for use in the home in such places as in the cellar or attic. It is available in pints and quarts.

Among other new Boyle-Midway products are two low-pressure aerosols, "Black Flag" and "Fly Ded." Both come in attractive lithographed cans with a push-button valve. Their early knockdown of household flies, mosquitoes, and other insects is attributed to a mixture of DDT and pyrethrins, reenforced by the synergist, piperonyl butoxide.

Hyman Appeals Injunction

The latest development in the patent dispute between the Velsicol Corp., Chicago, and Julius Hyman & Co., Denver, is that the Colorado Supreme Court has stayed the injunction order obtained by Velsicol against Hyman. The latter is thus continuing business with his "Octa-Klor" brand of the insecticide chlordane, while perfecting an appeal to bring the entire matter before the Supreme Court of that state.

Hyman developed the insecticide process in 1945 while he was executive vice-president of the Velsicol Corp. Velsicol alleges that he spent $150,000 of corporation funds on research and that during his 13 years with the firm had signed over 40 patents to them. A district court of Colorado has ruled favorably for Velsicol—that Hyman had an implied agreement to assign patent rights to Velsicol—and hence the injunction order.

Currently awaiting further action by the Colorado Supreme Court, both Velsicol and Hyman are manufacturing and selling the insecticide.

Insecticide Paint Regulations

The following rulings have been made by the Department of Agriculture concerning the application of the Federal Insecticide, Fungicide and Rodenticide Act and regulations:

1. *Shipbottom Paint.* Anti-fouling paints intended primarily to prevent the attachments of barnacles, oysters and other mollusks to the shipbottom, and to some extent prevent growth of algae, are not considered to be economic poisons under Act as at present administered and are not required to be registered. If claims for preventing the growth of seaweed appear on the labels for such products, they may become herbicides within the meaning the Act.

2. *Shingle Stain.* A product intended solely as a shingle stain is not subject to the Act but if it is intended for use as a fungicide to prevent decay of shingles, it would be an economic poison and would be required to be registered.

3. *Creosote Shingle Stain — Creosote Stain.* The same comment applies to these as to shingle stain.

4. *Mildew-Resistant Paint.* When certain additional ingredients are added to paint to make the paint mildew resistant and the product is described solely as being resistant against the effects of mildew on the paint, it is not considered an economic poison and is not required to be registered under the Act. However, if the product is intended to be applied to wood, for example, to destroy mildew which may already be attacking wood and causing decay, it would be an economic poison and would be required to be registered. The material intended to be added to the paint to make it mildew resistant would, of course, be an economic poison.

5. *Wood Preservatives.* Wood preservatives are ordinarily intended to prevent decay of wood or to prevent insect attack of wood, or both. Such products are economic poisons within the meaning of the law and if shipped in interstate commerce are required to be registered.

Chemical Cartridge Heats Soldering Iron

Requiring no electric current or external heat, a new soldering iron, named the Quik-Shot, utilizes a chemical cartridge that heats the iron to working temperature in 5 seconds, and maintains intense heat for fully 10 minutes. The cartridge, about the size of a small flashlight battery, contains a primer and is ignited in a manner similar to that of firing a bullet. When the cartridge is placed in the copper tip of the iron and a spring rod is pulled and released, the pointed rod strikes the primer and sets off the heating action, which is created

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by a chemical mixture of metal powders and an oxidizing agent. The cartridge is absolutely non-explosive. The heat developed is almost 200 watts, hence the iron can be used on heavy as well as light soldering jobs.

The Kemode Manufacturing Co., 2 W. 46th St., N. Y., N. Y., manufactures and distributes the iron, which retails for $4.95. This price includes a package of five cartridges.

Two New Coatings

The Dennis Chemical Co., St. Louis, Mo., has introduced two new products: an under primer and an oil resistant metal lacquer. Perma-Skin Underprimer is a quick-drying anti-corrosive underprimer that combines metal surface treatment with high anchorage of top coats and excellent adhesion to a variety of surfaces—such as cold rolled steel, aluminum, nickel, copper and stainless steel. Although it is an air drying material, adhesion in most instances is claimed to be superior to conventional baking primers. Underprimer can be used with practically all conventional finishing materials, such as oleoresinous paints, alkyds, baking enamels and lacquer. The new metal lacquer is recommended for use where oil resistance, toughness and maximum adhesion are required. Dennis No. 5062 lacquer will withstand 24-hour immersion in gasoline and 15-minute immersion in hot oil (275° F.) with no apparent deterioration in film strength or gloss. This coating has excellent adhesion to a variety of metal surfaces and has found particular application over "Cronak" treated metals. A complete line of colors is available.

Trade Endorses Rules On Water-Repellency

At a conference called by the Federal Trade Commission, representatives of the textile, rainware manufacturers, and chemical industries came to an agreement in principle on a set of proposed rules to distinguish the various fabrics in the trade called "waterproof", "all weather", and "weather-tight."

Where treated fabrics are actually impervious to rain or water, the term "waterproof" is still permitted under the rules proposed. However, two general classifications—"durable water repellent fabrics" and "retreatable water-repellent fabrics" are provided.

Insecticide Campaign Televised

In what is believed to be the first use of television to interpret the services of major firms in the chemical industries, D. S. Frederick, vice-president in charge of sales of Rohm & Haas, was interviewed, and the Rohm & Haas movie, "Our Constant Enemy—the Insect" was shown recently over a Philadelphia station.

Giant closeups of flies, roaches, moths, mosquitos, beetles, lice, worms, aphids and weevils living their destructive lives until succumbing to insecticides featured the dramatic phases of the show. Diagrammatic representations of the action of contact poisons, stomach poisons and fumigants carried the instructional aspect.

Mothproofing Compound In Clothing Line

Witty Bros., Inc., which manufactures clothing and sells through its own stores in the New York area, will process fabric for its entire line of suits, topcoats and overcoats, using the newly-developed Boconize, durable mothproofing compound of the Bocon Chemical Corp. There will be no additional charge for treatment with this product which is claimed to protect woolens against moth damage even after washings and 25 or more dry cleanings and not to alter the hand of the fabric.

1947 Water-Thinned Paints

Sales of water-thinned paints for 1947 totaled $40,342,235, compared with $40,546,587 reported for 1946, according to

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the Bureau of Census. Resin emulsion paint sales for 1947 declined 6 per cent from the 1946 figure. Cold water paint sales showed an increase of 5 per cent over 1946 sales, while the largest percentage increase, a rise of 89 per cent, was recorded for plastic-texture paints. The amount of all calcimines sold in 1947 was 3 per cent below that sold in 1946.

Win Patent Suit

The United States District Court at Wheeling, West Virginia, has entered judgment for the plaintiffs in a patent infringement suit based on McCulloch patent 2,044,176 for non-inflammable paint, holding the patent valid and infringed. The plaintiffs were Wm. E. Hopper & Sons Co. of Baltimore, owners of the patent, and The Watson-Standard Co. and Plicote, Inc., of Pittsburgh, exclusive licensees. The defendant was Blue Ribbon Paint Co. of Wheeling, West Virginia, and the product charged to infringe was Treesdale Flame Retardant Paint containing antimony trioxide and a chlorinated carrier.

Chemical Cloth

TutchOn Products Co., New York, is marketing a chemically treated cloth designed for the upkeep of furniture. It is claimed that the cloth, kept moist in a glass container, enables housewives to dust and polish various wood finishes simultaneously, without recourse to usual cleaning equipment and liquid polishes. Twelve active ingredients said to be a permanent part of the cloth.

New Du Pont Polishes

Two new products for use with automobile rubbing and polishing machines are now being marketed by the finishes division of the Du Pont Co. They are VZ-1196 "Duco" machine polishing compound No. 14 and VZ-1202 liquid machine polish. Both are designed for use by professional automobile refinishers.

The No. 14 compound cuts faster, is less greasy and is easier to clean up than previous Du Pont products of a similar nature. The liquid machine polish was developed to supply a satisfactory polish for use with standard polishing discs or lambs wool bonnets. It cleans and polishes quickly and will not mat the buffer.

New Launder-Ometers For Research Testing

The Atlas Electric Devices Co., 361 W. Superior St., Chicago, has developed two new Launder-Ometer models. The large capacity of these new machines makes them ideal for laboratory research in testing color-fastness of dyestuffs and launderability of materials.

Model L1Q has a capacity of 20 pint or 20 quart jars; Model L2Q will accommodate 20 pint, 20 quart or 6 half-gallon jars. Both units are available with varispeed drive unit for operation between 10 and 50 r.p.m.

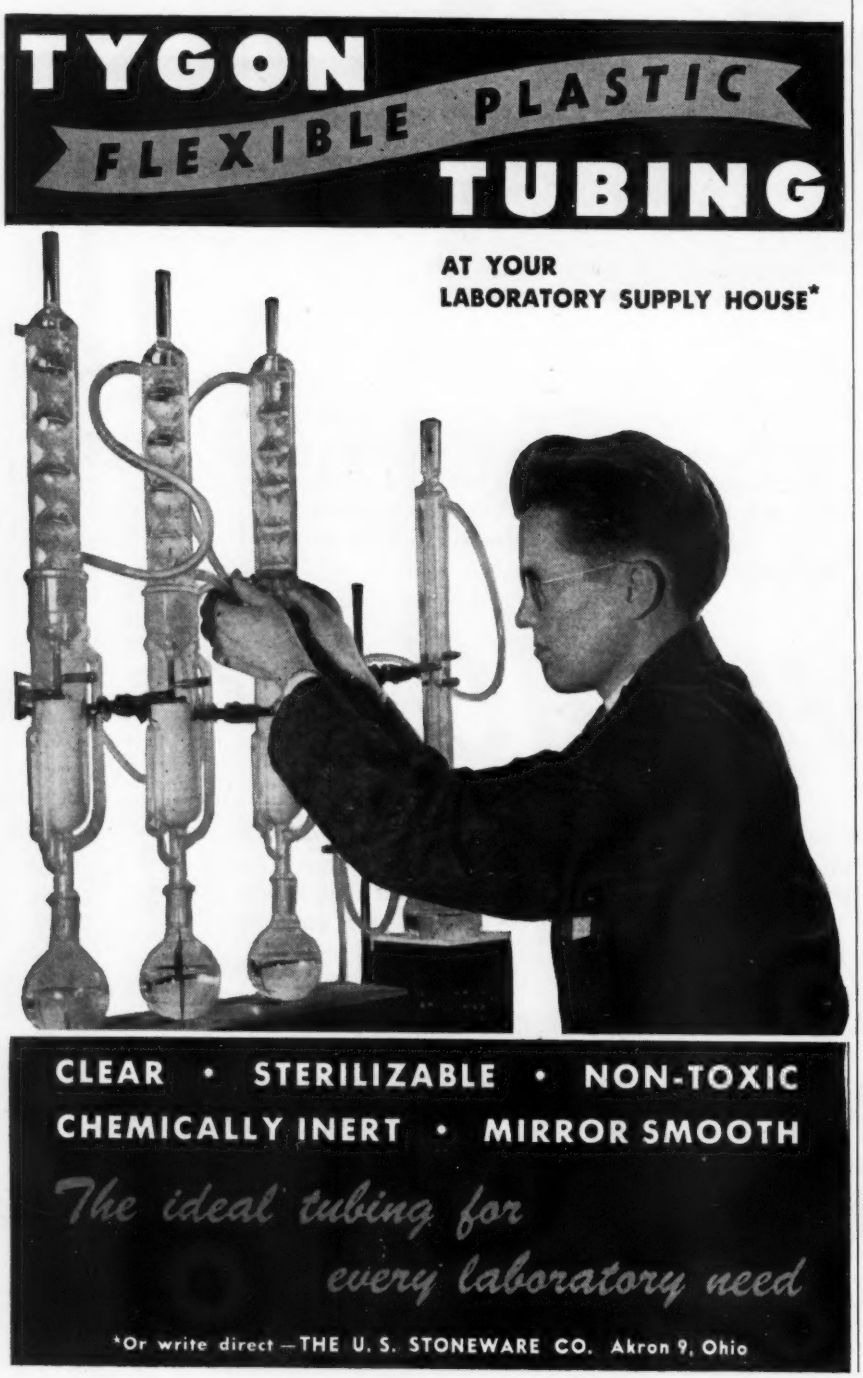
Mercury Disinfectants Cattle Hazard

K. Starr Chester, plant pathologist at Oklahoma A. and M. College, has warned Oklahoma farmers against feeding treated oats and barley seed to livestock.

Farmers may have a supply of this treated seed left over from their spring planting, Chester explains. Seed which has been treated, with seed disinfectants that contain mercury or lead can kill animals.

Purple Corn Shows Phosphorus Need

That purplish orchid color frequently observed in corn 10 days or so after it comes up means there is no enough phosphorus getting into the plant. Chemical tests on stunted corn plants that were turning purple showed that they contained only about one-half as much phosphorus as those that were growing rapidly and remaining green. An accurate soil analysis is the only way of knowing whether the plant-food shortage is due to a deficiency of phosphorus in



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the soil. While advocating nominal fertilizer applications in the row at planting time, agronomists point out that where phosphorus deficiency particularly has been noted, it would be well also to broadcast from 800 to 1,200 pounds of rock phosphate or 200 to 500 pounds or more of superphosphate per acre. This extra application of phosphorus, they say, might well be added before seeding clover, alfalfa, or other legumes, to be followed in turn by corn.

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The recent shortage of potash in Britain and the desirability of finding a non-imported substitute have led British scientists to re-examine the possibilities of common salt, which for centuries was a useful fertilizer for many of that country's crops.

Their grandfathers were right—it is a good fertilizer, especially for mangolds and sugar beet, particularly on light soils. The workers of Rothamsted found that it is often as effective as muriate of potash for sugar beet, and that it seems to help plant leaves to resist drought. Other workers have found that 5 cwt. of salt gave 5.1 cwt. of sugar, as against 3.4 cwt. when potash was used, plenty of nitrogen being supplied in both instances.

In addition to its fairly common use on mangolds, salt mixed with nitrate of soda was for long a popular top-dressing for wheat in some parts of the country. It has also been used for other cereals, notabley barley on light soils.

Farmers have commonly added salt to damaged hay to prevent mould in stacks and increase palatability. Few, however, have tried the effect of adding salt to good hay to preserve color and feeding quality and avoid loss of leaf.

A disadvantage is that salt depresses yield and quality of potatoes; but on the other hand, it has been used in strong solutions as a weed-killer. Charlock in mangolds and sugar beet has been destroyed by a 20% solution applied at the rate of 100 gal. per acre on a dry, hot day.

In all, there seems a lot that can be done with salt on the farm. Best of all, from the British viewpoint—it won't use up their dollars.

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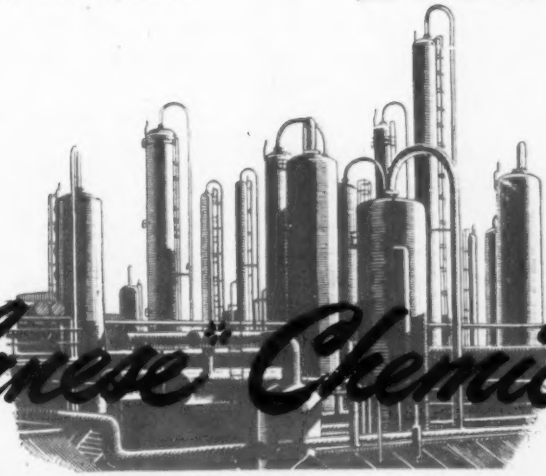

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CHEMICAL MARKETS

Soap Export Market Grows, Shifts

Meeting the needs of war-devastated countries, United States soap exports in the recent postwar period have risen to new highs from pre-war levels. Shipments of copra and other fats and oils under Government programs in the present year point to the effort being made by importing countries to remedy the world shortages of soap-making raw materials that have plagued them since the war.

Official export figures of this Government, besides emphasizing the part American-made soap has assumed in supplying international demands, reveal that both the markets abroad and the types of soap being exported, are undergoing postwar shifts.

Because of rising prices at home, statistics as to value of American soap exports are somewhat out of focus. However, compared with 1938's total of 26,513,472 pounds of soap exported from this country, the U. S. last year shipped 93,142,541 pounds, and the year before, 101,325,175 pounds.

In 1938, Latin America was the primary market for U. S. soaps, followed by Asia and North America. The tremendous pressure of health and relief needs since the war is credited with shifting these markets in importance, both in 1946 and 1947, first to Europe, then Latin America, and thirdly, other North American countries. Last year, Europe took 33.3 per cent compared to 14.1 percent in 1938; Latin America 31.5 percent, compared to its former 36.6 percent, and North America, 20.8 percent compared to 16.5 prewar.

Changes in foreign demand also have occurred since the war. Before that, many foreign markets were self-sufficient in the common types of soap. Now, judging by volume of exports, laundry and scouring soaps are first in demand, medicated and toilet soaps next.

Soda Ash Outlook Favorable

Plant expansions and an increase in natural soda ash available can bring the supply of soda ash into balance with demand if industrial peace can be achieved on all fronts of the industry. That is the optimistic view taken by those in the industry who see that outcome possible by the end of 1948.

Additional capacity of about 1,600 tons daily is expected from the expansion plans of four basic producers: Solvay division of Allied Chemical & Dye Corp. at Baton Rouge, Syracuse, and Detroit installations; Mathieson Chemical Corp.; Wyandotte Chemicals Corp.; and American Potash & Chemical Corp.

The Wyoming operations of Westvaco Chemical Corp. should add to the supply of natural soda ash. Some indication of the easing in this area is the OIT's announcement that reasonable quantities of natural ash will be approved for export without restriction. There has also been established an increase in the export quota for this quarter to 50,000 short tons of the manufactured, whereas 60,000 tons had been the combined total for manufactured and natural.

Bureau of Census figures show March production of soda ash by the ammonia process to total 404,525 short tons, wet and dry, as compared with 360,437 for February and 380,753 for March, 1947. Natural soda ash in March was 23,897 short tons, with 23,043 for February, and 23,071 for March a year ago.

Eastern consumers are unable to take advantage of the surplus of soda ash in the West Coast, which is going to export channels. Only a very severe shortage in the East could overcome the deterent of high freight rates.

Such tight conditions are not likely with the closing of price differentials between listed prices and those of lots for resale. Gray market operations are disappearing.

These good signs could be all wiped out by strikes in the coal mines or railroads, or by failure to bring to an end crippling strikes in the soda ash industry itself. The strike finally settled after a 77-day shutdown, at Pittsburgh Plate Glass Co.'s Barberton, Ohio plant, had caused losses that offset the gains from expansions elsewhere.

Inorganic Production At Record High

United States production of eight industrially important chemicals in March 1948 was the highest on record, according to the Bureau of Census. These eight chemicals, which are included in the Bureau's monthly survey of the production of 35 chemicals were: synthetic ammonia, ammonium nitrate, chlorine, hydrogen, phosphoric acid, soda ash, caustic soda, and sodium silicate.

Of the 35 chemicals in the survey, 31 were produced in larger volume in March than in February, 1948, and 29 in larger volume than March, 1947. Increased operational activity accounted for the increase.

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Market Review

Higher prices featured the market scene during the past month. In general, the effect of higher costs for raw materials, labor, and freight was shown in this trend. Some felt that increased inflationary pressure from labor negotiations throughout the industry was a contributing factor.

These advances occurred in all areas of the market with dyestuffs, acetanilide, aminopyrine, tartar emetic, oxalic acid, synthetic detergents, phthalic anhydride, glacial acetic acid, ammonia, and calcium arsenate among those affected. A 10 percent increase for dyestuffs was effective immediately on spot business, and July 1 on contracts. A 10¢ a pound increase in acetanilide brought the 150-lb. drum price of large lots to 50¢ per pound. A price of $6 per pound for 100-lb. lots of aminopyrine resulted from a 50¢ increase. Technical tartar emetic was at 44¢ per pound in barrels after a 3¢ advance attributed to the rising cost of antimony oxide. A July 1 increase of ½¢ per pound of oxalic acid prices it at 13¾¢ per pound in car lots.

Another July 1 advance places synthetic detergents at 14¢ per pound in carlots, up 1¢. Phthalic anhydride advanced 2¢ per pound, while glacial acetic acid went from $8.12 per CWT to $8.50 in tank cars. Du Pont followed the Lion Oil Co. in establishing a $70 a ton price in tank cars for anhydrous ammonia. An advance of 1¢ per lb. for calcium arsenate was the first change in this item in over a year.

In contrast to this upward trend was a 3¢ per gallon reduction on all formulae of industrial alcohol. This decrease in price was considered the recognition of a local competitive situation that had existed for some time. Another late reduction was a lowering of the price of menthol, but that was felt to be the result of sharp advances earlier in the month. With stocks in few hands, another advance was considered likely.

Requirements for bone and hide glues outstripped the efforts of producers to supply them. Solvents also were in a tight supply position, with only limited quantities of methyl ethyl ketone available for resale at 18¢ per pound.

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Buyer's Market Seen For Molding Materials

Continuing high levels of production of thermoseting molding materials were reported possible by Frank H. Carman, Plastic Materials Manufacturers Association, Inc., speaking before a section of the Society of the Plastics Industry, Inc. He reported that expanded production of material manufacturers is maintaining levels 12% above the 1947 total; production of thermoseting molding materials in 1947 was estimated at 236 million pounds.

Mr. Carman emphasized that this production, a new high, was meeting practically all requirements and probably can be increased somewhat in 1948. Based on the present requirements, there is no prospect of shortages and there is every indication that the industry is now entering into a buyer's market for molding material.

Dependence of the plastics industry on supply of basic chemicals was again stressed and here also an improved supply picture was given. Additional facilities for manufacture of methanol and formaldehyde have or will soon eliminate shortages of these basic chemicals. New facilities for the manufacture of urea will come into production in the last half of the year at which time it is expected full production of amino molding materials will be possible. Phenol production in 1948 is already somewhat above the 1947 average and a limited increase in production will be made in the third quarter. However, no substantial increase in phenol is believed possible or probable before 1950.

Production capacity for thermosetting molding materials is now believed to be ample and somewhat in excess of basic chemicals now available. If raw materials were available, he estimated that 1947 production could be exceeded by 50%.

Fertilizer Consumption Hits New High in 1947

Consumption of commercial fertilizer by American farmers during 1947, increasing for the ninth consecutive year, surpassed that for 1946, the previous all-time high. The annual report made by The National Fertilizer Association on the basis of tag sales data, shipments, reports of state officials and authoritative estimates, indicates that more than 15 million tons were consumed last year. This figure does not include raw phosphate rock, soft phosphate and colloidal clay, gypsum, or domestically-produced basic slag.

Although consumption during 1947 was only 165,000 tons greater than that in 1946, the increase is significant because it marked a new peak, and because it reflected peace-time demand for agricultural production rather than swollen war-induced demand. A comparison with the 1935-1939 prewar period, when annual

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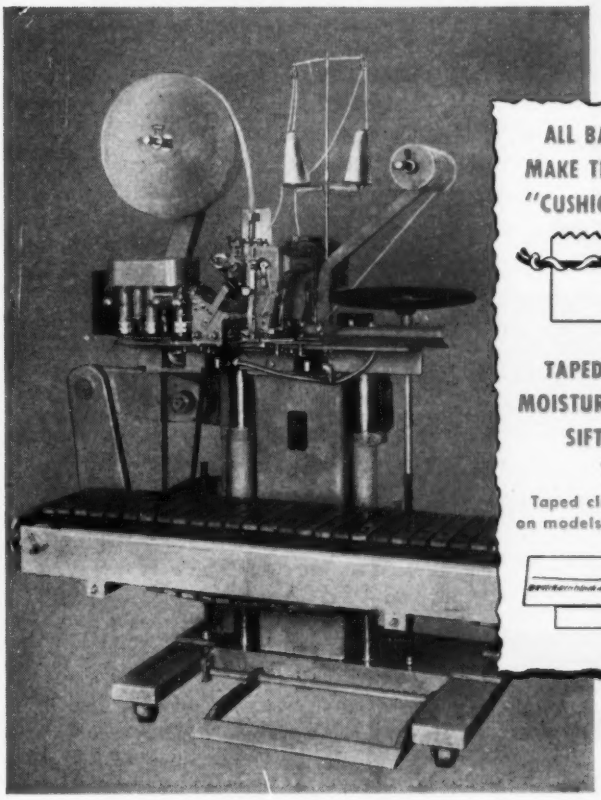

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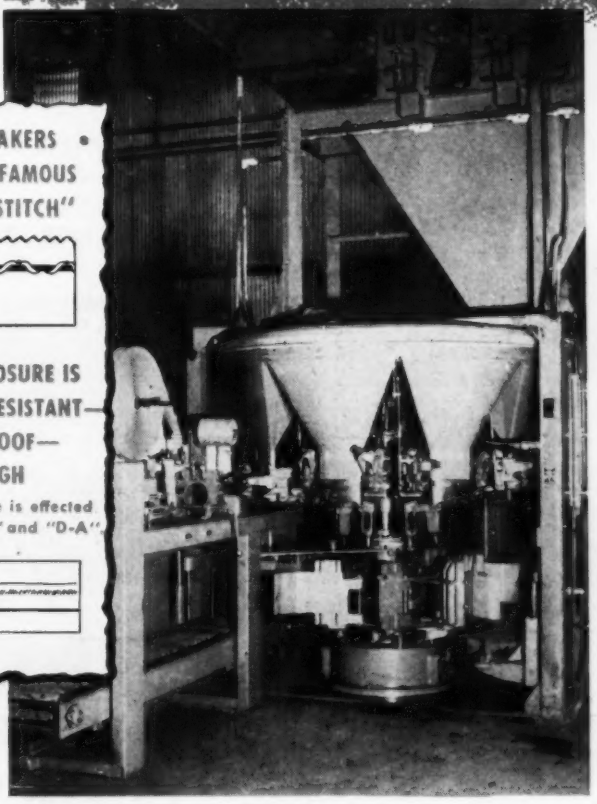

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fertilizer consumption averaged 7,338,000 tons, shows that consumption in 1947 has more than doubled. About 98 percent of the new total represented commercial distribution. Direct Government distribution through AAA and TVA during 1947 was about two-thirds as great as in 1946, and was at its lowest level since 1939. Distribution of fertilizer under the Government's "Purchase Order Plan" which is included in commercial distribution, increased 1 percent over 1946.

Set Chemical Export License Timetable

Issuance of licenses against export quotas for certain chemicals will proceed according to a definite timetable, commodity by commodity, the Department of Commerce has announced through its Office of International Trade.

Applications for a given chemical should be submitted to OIT within the fifteen days preceding the announced cut-off date. OIT officials emphasized that all applications received by OIT before the cut-off dates will receive equal consideration, without regard to the actual date of submission. License applications received after the third quarter cut-off dates applicable to the commodities covered by the application will be returned without action; such applications may be resubmitted for consideration against fourth quarter 1948 quotas, in accordance with the time schedule for that period.

The chemicals which have been selected for licensing on the timetable basis are Positive List items for which export applications far exceed available export quotas. They include caustic soda and soda ash, chrome compounds, lead chemicals, certain nitrogen compounds, benzol, phenol, and others.

In addition to the problem of application submission dates, the Committee gave detailed consideration to the question of what constitutes a suitable validity period for licenses to export chemicals. It was determined that in the case of chemicals a 90-day validity period provides sufficient time to effect shipment. OIT officials stated that extensions of export licenses are granted readily in the event that the request for extension is supported by a valid reason.

Native Sulfur Up

Production of native sulfur in April 1948 was 18 percent greater than in April 1947, according to the Bureau of Mines. The total shipped from the mines has been surpassed in only one month—November 1948, when 504,257 tons were shipped. Apparent sales were only slightly above those of April 1947. At the end of the month, stocks had decreased 32,689 long tons since January 1, 1948, and were 6 percent lower than on April 30, 1947.

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Industry's Bookshelf

(*Continued from page* 106)

place was initiated by the companies and not by the government.

In closing, the reviewer would like to remark that, after finishing this little tract, he had a strong feeling of having gone through the wringer of a very high-class sales job. More as a result of this than anything else, this volume might be termed a smooth apologia for the aluminum cartel.

Dairy Science

MILK AND DAIRY PRODUCTS, by *Lincoln M. Lampert.* Chemical Publishing Co., Inc., Brooklyn, N. Y., 1947. 291 pp., $7.00. Reviewed by L. J. Teply, Columbia University.

THIS VOLUME is admirably designed to present the fundamentals of dairy science to the layman not necessarily possessing previous knowledge of bacteriology or chemistry (no chemical formulas are given). The dairy scientist may find the book useful as a reference manual.

Chemical composition, nutritional aspects, preservation, processing and control of dairy products are discussed, with somewhat greater emphasis on the latter sections. The effect of crowding an amazing number of facts into a relatively short text is softened to some extent by a liberal use of pictures and charts and a sprinkling of interesting historical sidelights. Abstinence from verbiage in most sections has left room for fairly complete descriptions of most of the tests commonly used on dairy products. There are some 240 well-chosen references to key publications in the scientific literature.

One senses that the author, presently Senior Dairy Chemist, California Department of Agriculture, has a high personal regard for milk as a food; yet the discussion of margarine seems eminently fair, particularly in its citation of evidence indicating that margarine tends to resemble human milk fat more closely than butterfat.

The book is authoritative and up to date and its reading should prove rewarding to those interested in the field.

Organic Syntheses

ORGANIC SYNTHESES, Volume 27, *R. L. Shriner,* editor-in-chief. John Wiley & Sons, Inc., New York, 1947, 121 pp. $2.25. Reviewed by W. O. Fugate, American Cyanamid Company.

ORGANIC SYNTHESES has for many years been an essential part of the organic chemist's library and needs no introduction. As in previous volumes the procedures given have been carefully worked out, checked and edited. Directions are given for the preparation of the following compounds: β-alanine, β-aminopropionitrile and bis-(β-cyanoethyl)-amine, benzalacetone dibromide, biallyl, α-bromobenzalacetone, tert - butylamine, carboxymethoxylamine heminhydrochloride, decamethylenediamine, diethylaminoacetonitrile, dihydroresorcinol, 3,5-dimethyl-4-carbethoxy-2-cyclohexane-1-one and 3,5-dimethyl-2-cyclohexene-1-one, 1,5-dimethyl-2-pyrrolidone, 2,3-diphenylindone (2,3-diphenyl-1-indenone), 2,4-diphenylpyrrole, ethyl α-isopropylacetoacetate, 4-ethylpyridine, glycolonitrile, 5-hydroxypentanal, isatoic anhydride, 6-methoxy-8-nitroquinoline, 1-methyl-2-imino-β-naphthothiazoline, N-methyl-1-naphthylcyanamide, 1-methyl-1-(1-naphthyl)-2-thiourea, mucobromic acid, m-nitrodimethylaniline, 3-penten-2-ol, γ-n-propylbutyrolactone and β-(tetrahydrofuryl)-propionic acid, pseudothiohydantoin, rhodanine, stearolic acid, tetraiodophthalic anhydride, m-thiocresol, o-toluic acid, p-toluic acid, o-toluidinesulfonic acid, 1,3,5-tricacetylbenzene.

No typographical errors have been noted. One minor suggestion may be useful. Some of the procedures employ Raney nickel hydrogenation catalyst and the very active Raney nickel catalyst of Pavlic and Adkins (p. 35, ref. 2) would probably be preferable in most of these.

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By standardizing specifications, manufacturing operations and testing methods for light oil distillates, Barrett has helped to provide the consumer with aromatic solvents and diluents of a high degree of reliability.

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**Hi-Flash Solvent available at these stations.*

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CURRENT PRICES

Chemical prices quoted are of American manufacturers for spot New York, immediate shipment, unless otherwise specified. Products sold f.o.b. works are specified as such. Important chemicals are so designated.

Oils are quoted spot New York, ex-dock. Quotations f.o.b. mills, or for spot goods at the Pacific Coast are so designated.

Raw materials are quoted New York f.o.b., or ex-dock. Materials sold f.o.b. works or delivered are so designated.

The current range is not "bid and asked," are are prices from different sellers, based on varying grades or quantities or both.

Purchasing Power of the Dollar: 1926 Average—$1.00
July, 1946, $0.842 *July, 1947, $0.624*
July, 1948, $0.580

	Current Low	Current High	1948 Low	1948 High	1947 Low	1947 High
Acetaldehyde, 99%, drs wks lb.	.11	.12	.11	.12	.11	.15
Acetic Anhydride, drs, c.l., frt. all. E lb.	.13	.14½	.13	.14½	.11½	.14½
Acetone, tks, delv lb.	.07	.09	.07	.09	.07	.09
ACIDS						
Acetic, 28% bbls 100 lbs.	3.78	4.08	3.78	4.08	3.38	4.08
Glacial, synthetic C. P., drs, wks 100 lbs.	13.50	14.00	13.50	14.00	13.50	14.00
Acetylsalicylic, Standard USP lb.	.45	.59	.45	.59	.45	.59
Benzoic, tech, bbls lb.	.43	.47	.43	.47	.43	.47
USP, bbls, 4,000 lbs. up lb.	....	.54	....	.54	....	.54
Boric tech, bbls. c-l, frt. split tons	....	124.00	....	124.00	....	124.00
Chlorosulfonic, drs, wks lb.	.03	.04½	.08	.04½	.03	.04½
Citric, USP, crys, gran, bbls lb. *b*	.22	.23	.22	.23	.20	.23
Cresylic 50%, 210-215° low boil 50%, drs, wks, frt, equal gal.	1.48	1.61	1.26	1.48	1.01	1.26
Formic, 85%-90% cbys lb.	.12	.14½	.12	.14½	.10	.14½
Hydrofluoric, 30% steel, drs lbs.	.08	.09	.08	.09	.08	.09
Lactic, 22%, bbls, c.l., wks 100 lbs.	....	4.40	....	4.40	....	4.40
44%, light, bbls, wks lb.	.0815	.0855	.0815	.0855	.073	.0855
Maleic, Anhydride, drs lb.	.25	.27½	.25	.27½	.25	.26
Muriatic 18° cbys 100 lbs.	1.50	2.90	1.50	2.90	1.50	2.90
20° cbys, c-l, wks 100 lbs.	1.85	2.00	1.85	2.00	1.85	2.00
22° cbys, c-l, wks 100 lbs.	2.35	2.50	2.35	2.50	2.35	2.50
Nitric, 36°, cbys, wks 100 lbs. *c*	5.00	6.30	5.00	6.30	5.00	6.30
38°, c-l, cbys, wks. 100 lbs. *c*	2.35	5.50	2.35	5.50	....	5.50
40°, c-l, cbys, wks. 100 lbs. *c*	6.00	6.50	6.00	6.50	....	6.50
42°, c-l, cbys, wks. 100 lbs. *c*	6.50	7.00	6.50	7.00	....	7.00
Oxalic, bbls, wks lb.	.13	.14	.13	.14	.11¾	.14
Phosphotic, 100 lb. cbys, USP lb.	.10½	.13	.10½	.13	.10½	.13
Salicylic tech, bbls lb.	.31	.38	.31	.38	.26	.42
Sulfuric, 60°, tks, wks ton	12.25	13.50	12.25	13.50	....	13.50
66°, tks, wks ton	15.00	17.50	15.00	17.50	....	17.50
Fuming 20%, tks, wks. ton	18.00	20.50	18.00	20.50	....	20.50
Tartaric, USP, bbls lb.	.41½	.50	.41½	.50	.49½	.55
Alcohol, Amyl (from Pentane) tks, delv lb.	.17	.25	.17	.25	....	.25
Butyl, normal, syn, tks lb.	....	.17	....	.17	....	.17
Denatured, CD, proprietary solvent gal. *d*	1.03½	1.08½	1.03½	1.08½	1.00½	1.03
Ethyl, 190 proof tks gal.	18.04	18.13	18.04	18.13	18.04	18.08
Isobutyl, ref'd, drs lb.	....	.13	....	.13	....	.13
Isopropyl ref'd, 91% dms gal.	.44	.50½	.44	.50½	.41	.50½
Alum, ammonia, lump, bbls, wks 100 lbs.	4.05	4.25	4.05	4.25	....	4.25
Aluminum, 98.99% 100 lbs.	15.00	16.00	15.00	16.00	15.00	16.00
Chloride anhyd, l.c.l. wks. lb.	....	.10¼	....	.10¼	....	.10¼
Hydrate, light, bgs lb.	....	.17	....	.17	....	.17
Sulfate, com'l. bgs, wks, c-l 100 lbs.	1.15	1.30	1.15	1.30	1.15	1.30
Sulfate, iron-free, bgs, wks 100 lbs.	1.95	2.50	1.95	2.50	1.75	2.50
Ammonia anhyd. cyl lb.	.16	....	.16	....	.14½	.20
Ammonia, anhyd, frt, tank cars, wks, frt, equalized ton	....	59.00	....	59.00	....	59.00
Ammonium Carbonate, USP lumps, drs lb.	.08¼	.19	.08¼	.19	.08¼	.19
Chloride, USP bbls, drms, kgs lb.	.13	.15	.13	.15	.13	.15
Nitrate, tech, bgs, wks lb.	.0435	.0450	.0435	.0450	.0435	.0450
Oxalate pure, grn, bbls lb.	.23	.29	.23	.29	.23	.29
Perchlorate, kgs lb.	.25	....	.25	....	.24	.25
Phosphate, dibasic, tech, bgs lb.	.07	.07¾	.07	.07¾	.07	.07¾
Stearate, anhyd, drs lb.	....	.34	....	.34	....	.34
Sulfate, drs, bulk ton	30.00	40.00	30.00	40.00	30.00	38.00

USP $25 higgher: Prices are f.o.b. N. Y., Chicago, St. Louis, deliveries ½c higher than NYC prices, *a* Powdered boric acid $5 ton higher; *b* Powdered citric acid is ½c higher; *c* Yellow grades 25c per 100 lbs. less in each case; *d* Prices given are Eastern schedule.

Current Prices

Amyl Acetate Gums

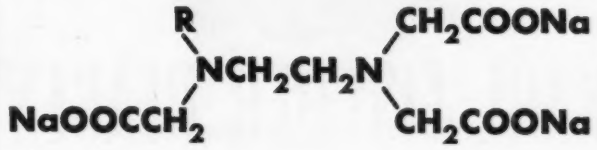
		Current		1948		1947	
		Low	High	Low	High	Low	High
Amyl Acetate (from pentane) tks, delv	lb.	.21	.29	.21	.29	.21	.24
Aniline, Oil, dms	lb.	.13	.15	.13	.15	.12	.14
Anthraquinone, 99.5%, bbls	lb.	.70	.80	.70	.80	....	.70
Antimony Oxide, bgs	lb.	.26	.29½	.26	.29½	.21	.31
Arsenic, whl, bbls, powd	lb.	.06	.08	.06	.08	.05	.08
Barium Carbonate precip, wks, bgs	ton	67.50	82.00	67.50	82.00	60.00	82.00
Chloride, tech, cryst, bgs, zone 1	ton	85.00	95.00	85.00	95.00	73.00	95.00
Barytes, floated, paper bgs	ton	....	33.30	....	33.30	....	41.95
Bauxite, bulk mines	ton	8.50	10.00	8.50	10.00	7.00	10.00
Benzaldehyde, tech, cbys, drs	lb.	.45	.55	.45	.55	.45	.55
Benzene (Benzol), 90%, tks, frt all'd	gal.	.19	.21	.19	.21	.19	.21
Benzyl Chloride, cbys	lb.	.20	.28	.20	.28	.20	.28
Beta-Naphthol, tech, bbls, wks	lb.	.23	.30	.23	.30	.21	.29
Bismuth metal, ton lots	lb.	....	2.00	....	2.00	....	2.00
Blanc Fixe, 66⅔ Pulp, bbls, wks	ton	55.00	65.00	55.00	65.00	40.00	60.00
Bleaching Powder, wks	100 lbs.	2.75	3.75	2.75	3.75	2.50	3.75
Borax, tech, c-l, bgs	ton	48.50	56.00	48.50	56.00	45.00	56.00
Bordeaux Mixture, bgs	lb.	.15	.23	.15	.23	.11	.23
Bromine, cases	lb.	.21	.23	.21	.23	.21	.23
Butyl, acetate, norm, dms	lb.	.30½	.36½	.30½	.36½	.26	.33½
Cadmium Metal	lb.	1.75	1.80	1.75	1.80	....	1.80
Calcium, Acetate, bgs	100 lbs.	3.00	4.00	3.00	4.00	3.00	4.00
Carbide, drs	ton	50.00	90.00	50.00	90.00	50.00	90.00
Chloride, flake, bgs, c-l	ton	21.50	38.00	21.50	38.00	18.50	38.00
Solid, 73-75% drs, c-l	ton	20.00	37.50	20.00	37.50	18.00	37.50
Gluconate, USP, bbls	lb.	.58	.65	.58	.65	.57	.65
Phosphate tri, bbls, c-l	lb.	6.50	6.80	6.50	6.80	6.50	6.80
Camphor, USP, gran, powd, bbls, 2,000-lb. lots	lb.	.66	.78	.66	.78	.75	.82
Carbon Bisulfide, 55-gal. drs	lb.	.05	.05¾	.05	.05¾	.05	.05¾
Dioxide, cyl	lb.	.06	.08	.06	.08	.06	.08
Tetrachloride, Zone 1, 52½ gal. drs	lb.	.06½	.07	.06½	.07	.06	.07
Casein, Acid Precip, bgs, 10,000 lbs. or more	lb.	.30	.35	.30	.35	.26	.35
Chlorine, cyls, lcl, wks, contract	lb.	.09	.15½	.09	.15½	.0 ¾	.10½
Liq, tk, wks, contract	100 lbs.	....	2.25	....	2.25	....	2.30
Chloroform, tech, drs	lb.	.20	.23	.20	.23	.20	.23
Coal tar, wks, crude, dms, c-l, wks	dm.	....	10.60	....	10.60	....	10.60
Cobalt, Acetate, bbl	lb.	....	.83¾	....	.83¾	....	.83¾
Oxide, black kgs	lb.	1.275	1.80	1.275	1.80	....	1.30
Copper, metal	100 lbs.	....	21.50	....	21.50	21.50	24.00
Carbonate, 52-54%, bbls.	lb.	.24	.26	.24	.26	.19½	.26½
Sulfate, bgs, wks cryst.	100 lbs.	7.60	8.00	7.60	8.00	7.10	8.60
Copperas, bulk, c-l, wks	ton	....	14.00	....	14.00	....	14.00
Cresol, USP, drs	lb.	.17¼	.19¼	.14	.19¼	.13¾	.15¾
Dibutylamine, c-l, drs, wks	lb.	.52½	.76	.52½	.76	....	.76
Dibutylphthlate, drs	lb.	.32	.38½	.32	.38½	.29	.38½
Diethylaniline, drs	lb.	....	.48	....	.48	....	.48
Diethylene glycol, drs, wks	lb.	.14	.16½	.14	.16½	.14	.15
Dimethylaniline, drs, cl., lcl	lb.	.21	.24¼	.21	.24¼	.20	.24¼
Dimethylphthalate, drs	lb.	.23½	.27½	.23½	.27½	.20	.24¾
Dinitrobenzene, bbls	lb.	.16	.21¾	.16	.21¾	....	.16
Dinitrochlorobenzene, dms	lb.	.14	.17	.14	.17	.14	.15½
Dinitrophenol, bbls	lb.	....	.26¾	....	.26¾	....	.22
Dinitrotoluene, refd., drs	lb.	....	.18	....	.18	....	.18
Diphenyl, bbls, lcl, wks	lb.	.15	.20	.15	.20	.15	.20
Diphenylamine, bbls	lb.	....	.25	....	.25	....	.25
Diphenyguanidine, drs	lb.	.35	.37	.35	.37	.35	.37
Ethyl Acetate syn. 85-90%, tks, frt. all'd	lb.	.09½	.13½	.09½	.13½	.09½	.12
Chloride, USP, bbls	lb.	.20	.22	.20	.22	.18	.22
Ethylene Dichloride, lcl, wks, E. Rockies, drs	lb.	.08½	.09½	.08½	.09½	.08½	.09½
Glycol, dms, cl	lb.	....	.13½	....	.13½	....	.12
Fluospar, No. 1, grd. 95-98% bulk, c-l mines	ton	....	37.00	....	37.00	....	37.00
Formaldehyde, bbls, cl & lcl	lb.	.0645	.0745	.0645	.0745	.0520	.0745
Forfural tech, tks	lb.	....	.09½	....	.09½	....	.13
Fusel Oil, ref'd, drs, dlvd	lb.	.26½	.29½	.26½	.29½	.18½	.29½
Glauber's Salt, Cryst, bgs, wks	100 lbs.	1.25	1.75	1.25	1.75	1.05	1.75
Glycerine dynamite, drs, c-l	lb.	.39½	.40¼	.39½	.40¼	.29½	.75¾
Crude Saponification, 88% to refiners tks	lb.	.23	.32	.23	.32	.23	.60

GUMS							
Gum Arabic, amber sorts bgs	lb.	.14	.15	.14	.15	.13¾	.15
Benzoin, Sumatra, cs	lb.	.40	.45	.40	.45	.50	1.00
Copal, Congo No. 1, bgs	lb.	.26	.29	.26	.29	.26	.29
Copal, East India, chips	lb.	no prices		no prices		no prices	
Macassar DBB, bgs	lb.	.24	.25	.24	.25	.24	.25
Copal Manila	lb.	no prices		no prices		.25	....
Karaya, bbls, bxs, drs	lb.	.20	.51	.20	.51	.20	.55

ABBREVIATIONS—Anhydrous, Anhyd; bags, bgs; barrels, bbls; carboys, cbys; carlots, c-l; less than carlots, lcl; drums, drs; kegs, kgs; powdered, pwd; refined, ref'd; tanks, tks; works, f.o.b., wks.

A New Word for Your Chemical Lexicon

SEQUESTRENE



Definition: a polyaminocarboxylic compound available either as sodium salt or purified free acid; a chelate forming compound capable of deionizing calcium, iron and other divalent or trivalent cations;

Synonyms: water softener; a non-hydrolyzable organic counterpart of the polyphosphates; a water soluble ion exchanger.

Uses: because of its ability to bind alkali earth and metal ions in a stable, non-ionized form, SEQUESTRENE has found uses as varied as: soap rancidity retardant . . . latex stabilizer . . . depressor in flotation . . . soap foam builder . . . anti-oxidant . . . anti-crocking agent for dyes . . . milk stone solvent . . . water softening agent . . . liquid soap clarifier . . . and in many other applications in detergents, cosmetics, pharmaceuticals, leather, textiles, rubber, foods, chemical processing . . .

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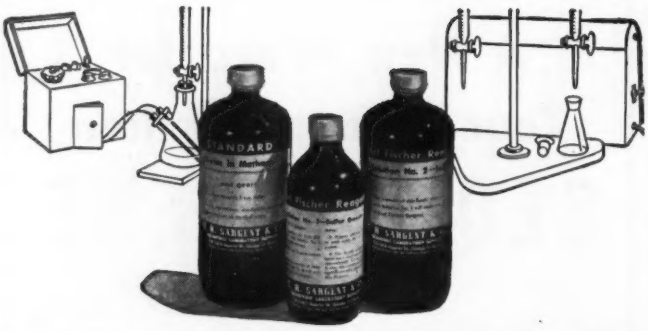
Quaternary Ammonium Compounds



KARL FISCHER REAGENT

for Rapid Direct Determination of Water

WIDE APPLICATION

Karl Fischer Reagent is the most specific reagent for water analysis known—Water content of a large number of organic and inorganic compounds can be directly determined simply by titrating the sample with this reagent. Use of Karl Fischer Reagent is particularly advantageous for water determinations of chemical compounds which cannot be made by oven methods because they are either volatile or decompose at oven temperatures.

Available literature indicates water determinations with this reagent have been successfully made on the following types of materials (see bibliography).

- The hydrated inorganic salts
- Monohydric and polyhydric alcohols
- Flexible glue compositions
- Native and processed cellulose
- Oils, fats, and waxes
- Naval stores products
- Liquid petroleum fractions
- Dry food materials
- Moisture in lacquer solvents and diluents A.S.T.M.

In addition to its use for the determination of water, the Karl Fischer Reagent has further wide spread use in the quantitative determination of functional groups of organic compounds.

RAPID

Analysis for water with the Karl Fischer technique is performed in only a few minutes as compared to the usual two to four hours required for oven methods. This time factor is particularly important for close control of many plant operations — for example water in processed materials can be determined during the processing and necessary adjustments made at once.

SHARP VISUAL ENDPOINT

The reagent itself is a deep orange brown and changes to a chromate yellow after it has been spent with water. The endpoint is sharp and easily detected.

ELECTROMETRIC TITRATIONS

With solutions which are highly colored or contain suspended solids, a pH meter or suitable electronic endpoint instrument with platinum-tungsten electrode system is used.

KARL FISCHER REAGENT—Set consisting of solution No. 1—Sulfur Dioxide; solution No. 2—Iodine (supplied in quantities sufficient to prepare 1 quart of Karl Fischer Reagent); 1 quart water in Methanol Standard.

Per set $10.00

Bulletin No. 249 with bibliography mailed on request.

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MICHIGAN DIVISION 1959 EAST JEFFERSON · DETROIT, MICHIGAN

Current Prices

Gums
Saltpeter

		Current Low	Current High	1948 Low	1948 High	1947 Low	1947 High
Kauri, N. Y.							
Superior Pale XXX	lb.	no prices		no prices		....	nom.
bgs	lb.	....	.32¾	....	.32¾	....	.31
Sandarac, cks	lb.	.95	1.50	.95	1.50	.85	1.00
Tragacanth, No. 1, cases	lb.	3.60	8.70	3.60	8.70	3.60	8.70
No. 3	lb.	2.00	2.50	2.00	2.50	2.00	3.45
Tacca, bgs	lb.	.06	.07	.06	.07	.06	.07
Hydrogen Peroxide, cbys	lb.	.15½	.18½	.15½	.18½	.15½	.18½
Iodine, Resublimed, jars	lb.	2.35	2.65	2.35	2.65	....	2.65
Lead Acetate, cryst, bbls	lb.	....	.20	....	.20	....	.19¼
Arsenate basic, bg, lcl	lb.	.23¾	.23¾	.22¾	.23¾	....	.23¾
Nitrate, bbls	lb.	.17¾	.20	.17¾	.20	....	.18
Red, dry, 95% PB^3O^4 bbls	lb.	....	.20¼	....	.20¼	.14¼	.19¼
97% Pb^3O^4 bbls, delv	lb.	....	.20½	....	.20½	.15	.19½
98% Pb^3O^4, bbls, delv	lb.	....	.21½	....	.21½	.15¼	.19¾
White, bbls	lb.	.16	.16¼	.16	.16¼	.13	.17¾
Basic sulfate, bbls, lcl	lb.	.15¼	.15½	.15¼	.15½	.12½	.15½
Lime, Chem., wks, bulk	ton	6.50	10.25	6.50	10.25	6.50	10.25
Hydrated, f.o.b. wks	ton	8.00	12.14	8.00	12.14	8.00	12.14
Litharge, coml, delv, bbls	lb.	....	.19¼	....	.19¼	.13	.17½
Lithopone, ordi., bgs	lb.	.05½	.06	.05½	.06	.03	.06
Magnesium Carb, tech, wks	lb.	.07¼	.10¾	.07¼	.10¾	.07¼	.10¾
Chloride flake, bbls, wks c-l	ton	....	40.00	....	40.00	....	37.00
Manganese Chloride, Anhyd. bbls	lb.	.12¾	.16	.12¾	.16	.14	.16
Dioxide, Caucasian bgs, lcl	ton	74.75	79.75	74.75	79.75	74.75	79.75
Methanol, pure, nat, dms *l*	gal.	.63	1.10	.63	1.10	.63	.73½
Synth, drs cl *m*	gal.	.34½	.41½	.34½	.41½	.31	.41½
Methyl Acetate, tech tks	lb.	.06	.09	.06	.09	.06	.07½
C. P. 97-99%, tks, delv	lb.	.09½	.12	.09½	.12	.09½	.10½
Chloride Indust., cycl, wks	lb.	.16	.41	.16	.41	.32	.41
Ethyl Ketone, tks, frt all'd	lb.	....	.12½	....	.12½	....	.09
Naphtha, Solvent, tks	gal.	....	.28	....	.28	....	.28
Naphthalene, crude, 74°, wks tks	lb.	.04½	.07	.04½	.07	.035	.08
Nickel Salt, bbls, NY	lb.	.14	.14½	.14	.14½	.14	.14½
Nitre Cake, blk	ton	20.00	24.00	20.00	24.00	....	24.00
Nitrobenzene, drs, wks	lb.	.08½	.10	.08½	.10	.08	.09½
Orthoanisidine, bbls	lb.	....	.80	....	.80	....	.70
Orthochlorophenol, drs	lb.	....	.37	....	.37	.25	.37½
Orthodichlorobenzene, drs	lb.	.07½	.10½	.07½	.10½	.07	.10
Orthonoitrochlorobenzene, wks	lb.	.15	.18	.15	.18	.15	.18
Orthonitrotoluene, wks, drs	lb.	.08	.11	.08	.11	.08	.09½
Paraldehyde, 98%, wks lcl	lb.	.12½	.13½	.12½	.13½	.22	.13
Chlorophenol, drs	lb.	.25	.29	.25	.29	.24	.29
Dichlorobenzene, wks	lb.	.12½	.14	.12½	.14	.12½	.14
Formaldehyde, drs, wks	lb.	.21	.23	.21	.23	....	.22
Nitroaniline, wks, kgs	lb.	.41	.43	.41	.43	.41	.43
Nitrochlorobenzene, wks	lb.	....	.18	....	.18	....	.18
Toluenesulfonamide, bbls	lb.	....	.70	....	.70	....	.70
Toluidine, bbls, wks	lb.	.44	.58	.44	.58	....	.53
Penicillin, ampules per 100,000 units, bulk		.14	.19	.14	.19	.14	.38
Pentaerythritol, tech	lb.	.32	.36	.32	.36	.27	.36
PETROLEUM SOLVENTS AND DILUENTS							
Lacquer diluents, tks, East Coast	gal.	.13	.16	.13	.16	....	.14
Naptha East, tks, wks	gal.	.11	.14	.11	.14	....	.11
Rubber solvents, East, tks, wks	gal.	....	.15	....	.15	....	.12
Stoddard Solvents, East, tks, wks	gal.	.11½	.14	.11½	.14	....	.12
Phenol, U.S.P., drs	lb.	.11¼	.13¼	.11¼	.13¼	.11¼	.13¼
Phthalic Anhydride, cl and lcl wks	lb.	.14½	.20	.14½	.20	.14½	.17½
Potash, Caustics, 88-92%, wks, sol	lb.	.05¾	.07½	.06¾	.07½	.06¼	.07½
Flake, 88-92%	lb.	.07½	.08¼	.07½	.08¼	.07	.08¼
liquid, 45% basis, tks	lb.	....	.03½	....	.03½	....	.03½
ds, wks	lb.	.0337½	.0375	.0337½	.0375	.03¼	.04
Carbonate hydrated 83-85%, bbls	lb.	.05¾	.06	.05¾	.06	.06	.05¾
Chlorate crys, kgs, wks	lb.	.08½	.09¾	.08½	.09¾	.08½	.13
Chloride, USP, cryst, bbls	lb.	.21	.22	.21	.22	.21	.22
Cyanide, drs, wks	lb.	....	.55	....	.55	....	.55
Iodide, drs	lb.	1.95	1.98	1.95	1.98	1.44	1.98
Muriate dom, 60-62-63% K^2O bulk unit-ton		.37½	.53½	.37½	.53½	.37½	.53½
Permanganate, USP, wks drs	lb.	.22½	.24	.22½	.24	.20½	.23
Sulfate, 90%, basis, bgs	ton	36.25	39.25	36.25	39.35	36.25	39.25
Propane, group 3, tks	gal.	.03½	.06¾	.03½	.06¾	.03½	.06¾
Pyridine, reg., drs	lb.	.60	.69	.60	.69	.55	.65
R Salt, 250 lb bbls, wks	lb.	.61	.72	.61	.72	....	.72
Resorcinol, tech. drs, wks	lb.	....	.68	....	.68	.64	.74
Rochelle Salt, cryst	lb.	.31½	.35	.31½	.35	.32½	.35
Salt Cake, dom, blk wks	ton	20.00	26.00	20.00	26.00	....	26.00
Saltpeter, grn, bbls	100 lbs.	9.75	10.25	8.00	10.25	8.20	9.50

l Producers of natural methanol divided into two groups and prices vary for these two divisions; *m* Country is divided into 4 zones, prices varying by zone. Spot price is ½c higher.

	Current Low	Current High	1948 Low	1948 High	1947 Low	1947 High
Shellac, blchd, bone dry, bbls.....lb.	.58½	.77	.58½	.77	.58½	.74½
Silver Nitrate, bots, 2,500-oz. lots.....oz.	.42¼	.48	.42¼	.48	.42¼	.59
Soda Ash, 58% dense, bgs, c-l, wks.....100 lbs.	....	1.38	....	1.38	....	1.38
58% light, bgs cl..100 lbs.	....	1.30	....	1.30	....	1.30
Caustic, 76% flake drs, cl.....100 lbs.	....	3.25	....	3.25	2.90	3.25
76% solids, drs, cl..100 lbs.	....	2.85	....	2.85	2.50	2.85
Liquid, 47-49%, sellers, tks.....100 lbs.	....	2.10	....	2.10	....	2.10
Sodium Acetate, anhyd. drs.....lb.	.06½	.11	.06½	.11	.06½	.11
Benzoate, USP drs.....lb.	.46	.52	.46	.52	.46	.52
Bicarb, USP, gran., bgs, cl., works.....100 lbs.	....	2.25	....	2.25	2.25	2.59
Bichromate, bgs, wks l.c.l.....lb.	.08¾	.09¼	.08¾	.09¼	.07⅞	.09¼
Bisulfate powd, bbls, wks.....100 lbs.	3.00	3.60	3.00	3.60	3.00	3.60
35° bbls, wks.....100 lbs.	1.40	1.65	1.40	1.65	1.40	1.65
Chlorate, kgs, wks cl.....lb.	....	.07¼	....	.07¼	....	.06¾
Cyanide, 96-98%, drs.....lb.	.14½	.15	.14½	.15	.14½	.15
Fluoride, 95%, bbls, drs...lb.	.09¾	.10	.09¾	.10	.07¼	.10
Hyposulfite, cryst, bgs, cl. wks.....100 lbs.	....	2.75	....	2.75	....	2.75
Metasilicate, gran., bbl, wks c-l.....100 lbs.	3.25	3.40	3.25	3.40	....	3.40
Nitrate, imp, bgs, c.l....ton	....	48.00	....	48.00	....	42.50
Nitrite, 96-98% bbl, cl...lb.	....	.06¾	....	.06¾	....	.06¾
Phosphate, dianhyd, bgs, wks.....100 lbs.	6.25	7.00	6.25	7.00	6.00	7.00
Tri-bgs, cryst, wks.....100 lbs.	3.40	3.90	3.40	3.90	2.70	3.90
Prussiate, yel. bbls, wks..lb.	.12	.12¼	.12	.12¼	....	.12¼
Silicate, 52°, drs, wks.100 lbs.	1.55	2.00	1.55	2.00	1.40	2.00
40°, drs, wks, c-l...100 lbs.	.95	1.15	.95	1.15	....	1.15
Siliconfluoride, bbls, NY..lb.	.06¼	.08½	.06¼	.08½	.06¼	.08½
Sulfate tech, Anhyd, bgs.....100 lbs.	2.10	2.60	2.10	2.60	1.70	2.60
Sulfide, cryst c-l, bbls, wks.....100 lbs.	....	3.75	....	3.75	....	3.00
Solid bbls, wks.....lb.	3.50	5.50	3.50	5.50	3.05	5.50
Starch, Corn, Pearl bgs.....100 lbs.	6.37	7.17	6.37	7.17	4.99	7.17
Potato, bgs, cl.....lb.	.0875	.1180	.0875	.1180	.0875	.1075
Rice, bgs.....lb.	no stocks		no stocks		no stocks	
Sweet Potato, bgs.....lb.	no stocks		no stocks		no stocks	
Sulfur, crude, mines.....ton	16.00	18.00	16.00	18.00	16.00	18.00
Flour, USP, precp, bbls, kgs.....lb.	.18	.30	.18	.30	.18	.36
Roll, bbls.....100 lbs.	2.45	3.40	2.45	3.40	2.65	3.40
Sulfur Dioxide, liquid, cyl..lb.	....	.09	....	.09	.07	.095
tks, wks.....lb.	.04½	.05	.04½	.05	....	.044
Talc, crude, c-l, NY.....ton	....	15.00	....	15.00	....	15.50
Ref'd c-l, NY.....ton	14.50	24.50	14.50	24.50	14.50	24.50
Tin, crystals, bbls, wks.....lb.	.55	.67	.55	.67	....	.60
Metal.....lb.	....	.91	....	.91	....	.80
Toluol drs, wks,.....gal.	.28	.37	.28	.37	.28	.29½
tks, frt all'd.....gal.	....	.23	....	.23	....	.23
Tributyl Phosphates, drs, lcl, frt all'd.....lb.	.66	.72	.66	.72	....	.72
Triet lorethylene, drs, wks..lb.	.09¼	.09¼	.09¼	.10½	.08	.10½
Trichesyl phosphate tks....lb.	.32½	.36	.32½	.36	.32½	.33
Triethylene glycol, drs.....lb.	.18½	.19½	.18½	.19½	.18½	.19½
Triphenyl Phos., bbls.....lb.	.26	.29	.26	.29	.26	.32
Wax, Bayberry, bgs.....lb.	.52	.55	.52	.55	no stocks	
Bees, bleached, U.S.P. cakes.....lb.	.65	.73	.65	.73	.68	.73
Candelilla, bgs, crude....lb.	.61	.65	.61	.65	.62	.80
Carnauba No. 1, Yellow, bgs, ton.....lb.	1.30	1.55	1.30	1.55	1.30	2.00
Xylol, Indus., frt all'd, tks wks.....gal.	.28	.30	.23	.30	....	.23
Zinc Chloride tech, fused, wks.....lb.	.0625	.0655	.0625	.0655	.05	.0655
Oxide, Amer., bgs, wks.. lb.	....	.11	.08½	.11	.09	.10
Sulfate, crys, bgs....100 lbs.	4.15	4.90	4.15	4.90	3.40	4.90
OILS AND FATS						
Babassu, tks.....lb.	.14½	.28½	.14½	.28½	.14½	.27½
Castor, No. 3, drs, c.l.....lb.	.20½	.34¼	.26½	.34¼	.27¾	.34¾
China Wood, drs, spot NY..lb.	.25¾	.27	.25¾	.27	.24	.41
Coconut, edible, drs Atlantic ports.....lb.	.18	.27	.18	.27	.18	.37
Corn, crude, tks, wks.....lb.	....	.32	....	.32	....	.31
Linseed, Raw, drs, c.l.....lb.	.2930	.3430	.2930	.3430	.3160	.3960
Menhaden, crude tks.....	.19	.22	.19	.22	.19	.22
Light, pressed, drs l.c.l...lb.	.16	.26	.16	.26	.16	.29
Palm, Niger, dms.....lb.	no prices		no prices		no prices	
Peanut, crude, tks, f.o.b. wks.....lb.	.17	.30	.17	.30	.20	.37
Perilla, crude, dms, NY....lb.	no stocks		no stocks		no stocks	
Rapeseed, bulks.....lb.	no prices		no prices		no prices	
Red, dms.....lb.	.17¾	.33¾	.17¾	.33¾	.17¾	.33¾
Soy Bean, crude, tks, wks...lb.	.15½	.29¾	.15½	.29¾	.15¼	.33
Tallow, acidless, dms.....lb.	.19½	.35	.19½	.35	.19½	.35

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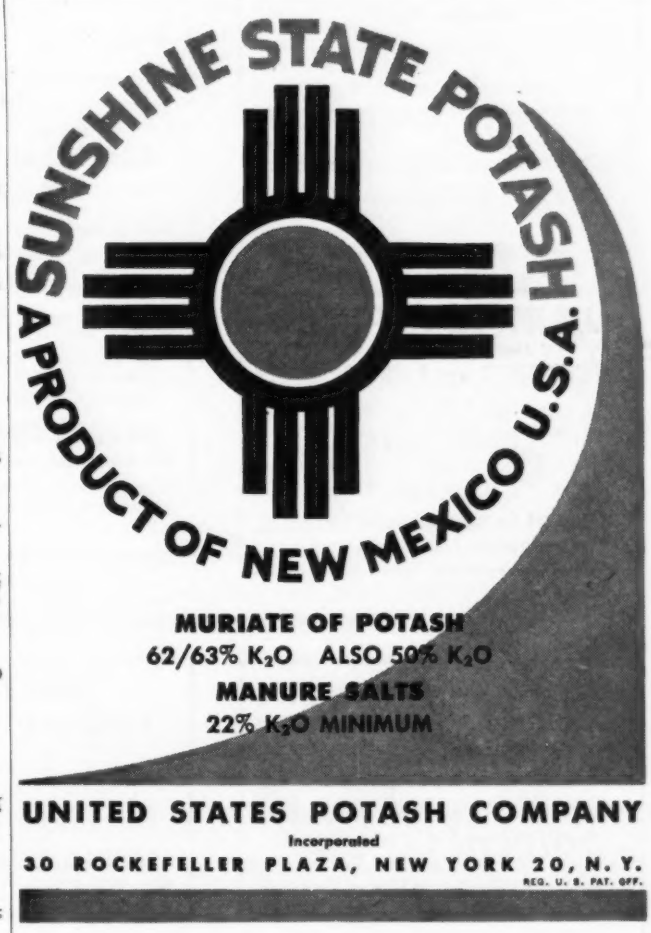
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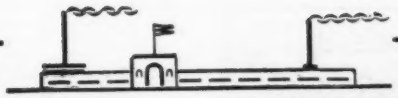

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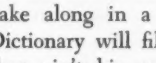
"WE"—EDITORIALLY SPEAKING

WEBSTER'S UNABRIDGED is not the sort of book you'd take along in a canoe, and the Oxford Dictionary will fill a five-foot shelf. But they ain't big enough. The packaging specialists of Du Pont's Cellophane Division had to go and make up a word, "spurchases," to describe spur-of-the-moment buying. The items so bought are manufactured, presumably, by the sproduction department from materials obtained by the vi-spresident in charge of sprocurement.

That's all right, fellows; we like to coin a word ourselves now and then. What would the English language amount to without sprogress?



MARVIN UDY told recently how a woolen shirt, accidentally dropped into a cadmium plating bath, led to the discovery of bright plating with cadmium.

Since reading that we've been dropping our old socks into any handy solution, and one of these days we'll be sitting in our private park, tossing $100 bills in the air just to watch them float on the breeze.

IT RAINED half of the days in June, and May was even wetter. We're mighty suspicious of those goings-on up in Schenectady, and we're going to collect some of the rain and analyze it with our Chemcraft set for silver iodide.

THE NATIONAL Smoke Abatement Society, over in Great Britain, is trying hard. Its task is made no easier, however, by some bumbling propaganda issued by the Government, which shows a factory chimney belching forth a cloud of heavy black smoke and explains in the caption, "Smoking chimneys spell prosperity." Now the Society is hot on the heels of the pamphleteers, urging them to choose a more discreet symbol of industrial productivity.

A PUZZLED FEMALE FRIEND of ours was curious about chemical engineers and how they differ from chemists. We explained that chemists dream up these wonderful new products—"Better Things for Better Living," etc.—and the engineer is like a plumber who puts pipes and tanks together to give substance to the chemist's flashes of genius. (We modestly explained that we were trained as a chemist.) "I know," our friend said, "that engineers build things, but I wonder how they ever come out right. I watched one working with his ruler, and all the inches were of a different size."

EDUCATORS ARE understandably touchy about comparisons of their institutions to mass-production lines. That the analogy is at least partially justified is supported by the announcement of a "robot professor" that grades ten true-and-false papers a minute with 99 per cent accuracy.

Sometimes we wonder if there isn't too much emphasis on the "right answer." The bright student nowadays is the one who can snap back "true" or "false" or "yes" or "no" and remember the professor's exact words a week ago Thursday and what it says in the second paragraph on page 388 of the textbook. The ability to conceive an original thought seldom pays off—at least on the undergraduate level—and the laurel wreath encircles the photographic mind. The tremendous increase in college enrollment—which necessitates such mechanical procedures—is, we suppose, a Very Good Thing; but we fear that the waters of knowledge, flowing out over a wide area, are bound to become shallow.

WHILE RUMINATING on the above, we remembered one course, biochemistry, where we might just as well have been lectured to by a ventriloquist's dummy. It was an "8-o'clock" and a mile and a half uphill from our fraternity house. A hearty breakfast and a fast walk (to get us there by the bell) put us sound asleep by 8:04. We always took a seat behind a large opaque boy who eclipsed us from the professor's gaze.

JUDGING FROM our patent abstracts this month, a fellow named Drexel Hill seemed to be a prolific inventor. His name always followed the co-inventor's, and all the patents were assigned to various Philadelphia concerns. Came the dawn and the remembrance of a Philadelphia suburb by that name. The mythical Drexel Hill who worked all hours for Rohm & Haas, Atlantic Refining, and a host of other firms, was transmogrified from an indefatigable researcher into a spot on the map.

FIFTEEN YEARS AGO

(From Our Files of July, 1933)

The Industrial Control Act is now being set up under the administration of General Hugh S. Johnson. To date it has not been decided whether the advisory board will deal with the chemical industry as a whole or with a large number of small units. Many members of the industry feel that a better deal may be made if each industry division arrives in Washington with a fully prepared code.

American industry continues to migrate to foreign countries due to the increasing pressure of the Canadian and British tariff. At the end of 1932, 711 American companies had located abroad in an effort to supply the foreign markets by locating within the tariff walls.

The corn refining industry reported the heaviest volume of business for one month in May. Total corn grind — 8,800,000.

Zapon, a subsidiary of Atlas Powder, has developed a revolutionary finish known as Sprayed Izarine Finish. With this a suede-like finish can be given to any article by spraying, instead of laborious mounting.

The Japanese chemical business is making notable progress in the production of both heavy and fine chemicals. Production of sulfate of ammonia and calcium cyanide has increased greatly and 13 superphosphate factories are producing exportable surplus.

THIRTY YEARS AGO

(From Our Files of July, 1918)

War conditions are restricting the color and dyestuffs markets. Importations of dye bases and dyewoods are being restricted and crude materials are needed for munitions. Prices are skyrocketing due to the pressing demand.

United States exports of heavy chemicals to Hong Kong are heavy at the present time, but it is doubtful if this country can hold the trade after the war. Chinese trade relations with Great Britain have been so close that the trade will probably return to them.

Certain concerns are being charged with profiteering in aqua ammonia. It is said that prices have been advanced as much as 200 to 300 per cent. Leading chemical companies are offering this product at government fixed prices.

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U. S. Patents from Official Gazette—Vol. 607, Nos. 2, 3, 4; Vol. 608, Nos. 1, 2, 3 (Feb. 10-Mar. 16)
Canadian Patents Granted and Published April 20-May 11

*Polymers

Canadian

A polymerization reactor. No. 447,469. William J. Sparks and Donald C. Field (to Standard Oil Development Co.)

A composition comprising a polyvinyl acetal resin and the tartrate of hexamethylenetetramine as a stabilizer. No. 447,481. Fred Ward Cox (to Wingfoot Corp.).

Preparing a film having improved resistance to the transmission of water vapour by a copolymer of vinylidene chloride and vinyl cihloride dissolved in a liquid solvent in which the cellulose acetate is insoluble, but which causes said cellulose acetate to swell. No. 447,483. LaVerne Emerson Cheyney (to Wingfoot Corp.).

Protective coating composition comprising two parts polymerized butyl methacrylate, approximately one part copolymers of vinyl chloride and vinyl acetate and approximately 0.75 parts normally solid chlorinated diphenyl. No. 447,779. James Willard Humphrey (to American Viscose Corp.).

Composite material comprising a heat treated, thermosetting phenolaldehyde resin, a plurality of glass fibres distributed in the phenolaldehyde type resin, and a tenaciously adherent coating of a thermoplastic reaction product of polyvinyl acetate and an aldehyde on the glass fibres, the coating providing for a good bond of the phenolaldehyde type resin to the glass fibres. No. 447,801. James G. Ford and Roger D. Spencer (to Canadian Westinghouse Co., Ltd.).

Thermoset laminated member, the resin composed of a thermoplastic resinous poylmer up to 30 per cent of the total weight of the resin and the balance being the reaction product of a phenol, an arylamine in an amount of from 20 per cent to 125 per cent of the weight of the phenol and formaldehyde in an amount of from 0.8 to 1.5 mols for each mol of phenol and arylamine combined, the reaction being catalyzed with a basic catalyst. No. 447,810. Fritz J. Nagel and Bruce C. Nash (to Canadian Westinghouse Co. Ltd.).

Apparatus for shaping tablets from mouldable resinous materials in powder form. No. 447,832. Hugo Adolf Maria Winter (to Hornfiowa, Ltd.).

Moulding powder comprising disintegrated redwood pulp retaining substantially all non-volatile ingredients, 15-40 per cent furfuryl alcohol-formaldehyde resin, and a minor amount of boric acid. No. 447,834. Edward Reineck and Isaac R. Dunlap (to Institute of Paper Chemistry).

Polymers of the propiolyl halides. No. 447,626. Frederic Charles Schaefer (to Wingfoot Corp.)

Polyamides from a dicarboxylic acid and ethylene bis (3-aminopropyl ether. No. 447,627. Albert Mitchell Clifford and Joy Gabriel Lichty (to Wingfoot Corp.).

*Processes and Methods

Two-stage fluidized catalyst cracking process. No. 2,434,434. Davis Read, Jr. (to Universal Oil Products Co.)

Contacting hydrocarbons with catalyst particles. No. 2,434,567. Charles E. Jahnig, Charles W. Tyson to Standard Oil Development Co.).

Preparing spheroidal catalyst-particles for use in moving-bed catalyst reaction systems. No. 2,435,379. Raymond C. Archibald (to Shell Development Co.).

Canadian

A method of operating heat exchangers with two separate channel systems in heat exchange relation comprising the steps of passing a heat exchanging fluid through each channel system, directing the flow of each heat exchanging fluid alternately through another one of the channel systems, and turning over the heat exchanger at suitable intervals so as to cause its top and bottom portions to change places. No. 447,378. Carl Johan Lockman (to Aktiebolaget Rosenblads Patenter).

In a method for carrying out chemical reactions by passing a gaseous reaction mass over a volatile catalyst disposed on a non-voatile supporting base at a temperature at which the catalyst volatilizes from the base, the improvement which comprises passing the gases through a bed of the supported catalyst at such temperature and then through a mass of the catalyst support free from catalyst at a temperature at which the volatilized catalyst re-condenses on the support. No. 447,482. John Royer Long and Clyde Edgar Gleim (to Wingfoot Corp.).

Method of utilizing waste heat available at a plurality of widely scattered heaters. No. 447,501. David Dalin.

Conducting vapour phase reaction in the presence of a powdered catalyst suspended in the vapours. No. 447,601. Bruno E. Roetheli and Walter G. Scharmann (to Standard Oil Development Co.).

*Rubber

Recovering rubber from guayule shrub comprising comminuting shrub, milling in aqueous coagulant medium and floating rubber "worms". No. 2,434,412. Edwin P. Jones (to United States of America).

Manufacture of synthetic rubber-like materials by polymerization of conjugated diolefin hydrocarbon in aqueous emulsion in presence of aliphatic mercaptan polymerization modifier. No. 2,434,536. Erving Arundale (to Standard Oil Development Co.).

Production of vulcanizable isobutylene-isoprene copolymers. No. 2,434,582. Reuben F. Pfennig, and Melvin H. Bertz (to Standard Oil Development Co.)

*Specialties

Emulsion, comprising pitchy residue from distillation of tall-oil, precipitated calcium carbonate and double salt of calcium carbonate and sodium carbonate. No. 2,434,243. Sixten Magnus Hjelte.

Rust preventive lubricating oil. No. 2,434,490. Gordon W. Duncan (to Standard Oil Development Co.)

Producing anhydrous greases. No. 2,434,539. Alan Beerbower, Arnold J. Morway (to Standard Oil Development Co.).

Non-gelling surface active composition. No. 2,434,683. Marinus Buis, Dillwyn Morgan Samuel (to Shell Development Co.).

Preparing clear, odorless and fungus mold resistant photo-sensitive lithographic solution. No. 2,434,727, Charles H. Van Dusen, Jr. (to Addressograph-Multigraph Corp.).

Stabilization of fatty materials prone to oxidation. No. 2,434,790. Loran O. Buxton and Charles E. Dryden (to Nopco Chemical Co.).

Synthetic hydraulic and lubricating fluid. No. 2,434,978. William A. Zisman, and Hayward R. Baker (to United States of America).

Dispersing foam-reducing silicon-containing compound in hydrocarbon lubricating oil. No. 2,435,124. Loren C. Bollinger (to Shell Development Company).

Composition of matter consisting of metal sulfonate of petroleum sulfonic acid and fluoro-organic compound. No. 2,435,205. Garland H. B. Davis and John C. Zimmer (to Standard oil Development Co.).

Composition of matter consisting of mineral lubricating oil and oil-insoluble anti-foaming agent. No. 2,435,206. Garland H. B. Davis and John C. Zimmer (to Standard Oil Development Co.).

Well drilling fluid suitable for use in wells having a ground temperature of 160° F. and comprising aqueous suspension of colloidal clay and finely divided ferrophosphorus. No. 2,435,211. James M. Gillet (to Victor Chemical Works).

Solvent for degreasing iron and aluminum. No. 2,435,312. Walter Klabunde (to E. I. du Pont de Nemours & Co.)

Detergent briquette free from from a silicate, physically stable, hard, strong and non-deliquescent. No. 2,435,453. James Douglas MacMahon (to The Mathieson Alkali Works, Inc.).

Canadian

Method of removing oil residue from the surface of magnesium-base alloy articles with an aqueous solution containing between about 1 and about 5 per cent by weight of an alkali metal tartrate and between about 1 and about 5 per cent of an alkali metal hydroxide. No. 447,411. Herbert K. De Long (to Dow-Midland, Michigan).

A polishing composition containing cerium oxide 32 parts, barium carbonate 8 parts, barium hydroxide 1 part. No. 447,524. Lincoln Milton Polan.

Emulsifying and whipping agent of 24 parts of a condensation product of sorbitan mono stearate and ethylene oxide and 6 parts of a condensation product of sorbitan mono stearate and ethylene oxide emulsified in water. No. 447,609. Norman F. Johnston (to R. T. Vanderbilt Co., Inc.).

*Textiles

Flexible unwoven fabric formed integrally in situ, stimulating fabric made of distinct filaments composed of synthetic organic plastics material. No. 2,434,532. Hugo Wurzburger (to Paul D. Wurzburger).

**U.S. Patents from Vol. 606, Nos. 2, 3, 4. Vol. 607, No. 1. Canadian from March 23-April 13.*

Single filament of synthetic organic plastic material having helical groove formed in its outer surface and extending continuously from end to end of filament with predetermined pitch. No. 2,434,533. Hugo Wurzburger (to Paul D. Wurzburger).

Treating animal fibers such as wool, hair, and fur which contain keratin and having plurality of disulfide linkages in molecule. No. 2,434,562. Milton Harris (to Textile Foundation).

Aqueous solution for treating rayon made from alkali metal hydroxide, urea, and zinc oxide. No. 2,434,621. (to United Merchants & Mfg., Inc.).

Apparatus for wet spinning solution of organic colloidal material susceptible to progressive change in viscosity on ageing. No. 2,435,416. Robin H. K. Thomson and William Sever (to Imperial Chemical Industries, Ltd.).

Splicing thermoplastic monofilament fabric. No. 2,435,467. George A. Spencer (The Firestone Tire & Rubber Co.).

Canadian

Textile fibres from casein. No. 447,640. Antonio Ferretti.

Producing shrinkage effects on textile materials having a basis of an organic derivative of cellulose with a mixture of methylene chloride and ethylene dichloride. No. 447,750. Frank Brentnall Hill (to Claude George Bonard).

Process for making artificial wool imitation filaments comprising making alkali-cellulose, shredding sulphidizing without ageing it to form xanthate, dissolving said xanthate into viscose, filtrating and spinning into a spinning bath containing zinc sulphate, to form filaments and withdrawing under tension. No. 447,777. Henry Von Kohorn (to American Patent Development Corp.).

*Water Sewage and Sanitation

Fused unitary vitreous composition for use as detergent water treating agent and denocculant. No. 2,434,674. Alexis G. Pincus (to American Optical Co.).

Water purifier. No. 2,434,958. David H. Quinn.

Cartride for filtering and degassing water. No. 2,435,510. Lloyd E. Rabjohn).

Canadian

Reagent for water-softening by milling commercial sodium aluminate with a substance selected from the group consisting of a starch, sodium tannate, potassium tannate, a mixture of starch and potassium tannate. No. 447,740. John Oswald Samuel and Geraint Hopkins (to Unifloc Reagents Ltd.).

Agricultural

Herbicidal composition comprising water-soluble pentachlorophenolate as principal phytotoxic ingredient and, as activator, water-soluble salt of strong acid and weak base. No. 2,435,676. Charles D. Fitzgerald and George E. Lynn to The Dow Chemical Company.

Coating Composition in the form of an emulsion comprising an aqueous solution of a protein as the continuous phase, and a hydrophobe disperse phase comprising dehydrated castor oil. No. 448,419. Herman A. Scholz, John K. Wise, Joseph W. Gill and Marvin T. Schmidt to Canadian Gypsum Company Limited.

Insecticidal composition comprising 5-10% ortho-nitrodiphenyl, 20-50 mg. of pyrethrins per 100 cc. of composition, deodorized petroleum oil spray base and ortho-phenylcyclohexanol or ortho-cyclohexylcyclohexanol to retain ortho-nitrodiphenyl in solution. No. 2,435,690. Henry J. Morrill and Carl J. Weinman to Monsanto Chemical Company.

Destroying flying insects comprising contacting insects with composition containing member selected from N-butylphthalimide and N-amylphthalimide as knockdown agent and 2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane as active insecticidal ingredient. No. 2,436,919. Samuel I. Gertler and Herbert L. J. Haller.

Fly spray comprising member selected from N,N-dipropylcinnamamide and N,N-diisopropylcinnamamide as knockdown agent and 2,2-bis (pchlorophenyl)-1,1,1-trichloroethane as active insecticidal ingredient, in mineral oil carrier. No. 2,436,-920. Samuel I. Gertler and Herbert L. J. Haller.
Insecticidal composition comprising as toxic agent water-insoluble, organic solvent-soluble phenyl caprylphenoxyacetate dispersed in carrier. No. 2,437,427. William F. Hester and W. E. Craig to Röhm & Haas Company.

Insecticidal composition comprising as toxic agent halocaprylphenoxyacetic acid and carrier therefor. No. 2,437,527. William F. Hester and W. E. Craig to Röhm & Haas Company.

Biochemical

Nephelometer for assaying pencillin. No. 2,436,145. Frank H. Johnson.

Method of cultivating Pencillium notatum. No. 2,437,766. Elmer C. Stevenson and John W. Mitchell.

Purification of fermented liquors. No. 2,437,939. Ralph T. K. Cornwell and Donald S. Porter to American Viscose Corporation.

Cellulose

Production of molding powder from lower aliphatic ester of cellulose. No. 2,435,999. Henry Dreyfus, James Henry Rooney and Bernard Shaw to Celanese Corporation of America.

Cellulose organic acid ester plastic comprising cellulose organic acid ester selected from cellulose acetate, cellulose propionate, cellulose butyrate, cellulose acetate-propionate and cellulose acetate-butyrate, plasticizer therefor, and, as agent for inhibiting deterioriation of plastic by ultra-violet light, approximately 1%-2% based on weight of cellulose ester, of resorcinol monobenzoate. No. 2,436,116. Lester W. A. Meyer and William M. Gearhart to Eastman Kodak Company.

Regenerated cellulosic pellicle impregnated with aqueous solution comprising guanidine thiocyanate. No. 2,436,181. Charles M. Rosser to American Viscose Corporation.

Composition embodying cellulolose derivative and containing, as plasticizer, ethyl acetonyl phthalate. No. 2,436,361. Lucas P. Kyrides to Monsanto Chemical Company.

Bleaching cellulose textile fibers. No. 2,438,100. Thomas C. Whitner to Chemical Laboratories, Inc.

Plastic composition comprising a cellulose ester of a saturated straight-chain fatty acid with from 2 to 4 carbon atoms and as a plasticizer therefor a hexide diester the acyl radicals of which are selected from the group consisting of the acyl radicals of acetic, propionic and butyric acids. No. 448,253. Rudolph Max Goepp, Jr. to Atlas Powder Company.

Canadian

Apparatus for the treatment of cellulosic material. No. 448,225. James Brookes Beveridge and Richard D. Kehoe.

Ceramics

Transparent optical glass contains 20% to 80% CdO, 2% to 50% SiO_2, 0% to 30% Al_2O_3 and 0% to 40% B_2O_3. No. 2,435,995. William H. Armistead to Corning Glass Works.

Producing sintered electrical insulators consisting essentially of alumina. No. 2,436,005. Bernard Hopps and Colin James Smithells to Lodge Plugs Limited.

Ceramic mixture comprising 90 parts by weight of crystallized alumina, 5.6 parts of boron oxide, 4.4 parts of lime, 0 to 5 parts of silica, 0 to 2 parts if iron oxide. No. 2,436,708. Louis Bonnet and Maurice Marty.
Vitreous enamels comprising 3-6% Na_2O, 1-5% K_2O, 3-5% Li_2O, 1-3% BaO, 1-5% CaO, 5-7% ZnO, 7-9% B_2O_3,20-25% Al_2O_3, 22-25% P_2O_5, 7-15% SiO_2, 3-5% F_2 and 6-10% ZrO_2. No. 2,436,825. Harold D. Prior to The Titanium Alloy Manufacturing Company.

Ceramic Dielectric comprising essentially barium titanate with a small admixture of magnesium titanate. No. 2,436,839. Eugene Wainer (to The Titanium Alloy Manufacturing Co.)

Ceramic dielectric consisting of ceramic mixture of magnesium titanate and zinc titanate. No. 2,436,840. Eugene Wainer to The Titanium Alloy Manufacturing Company.

Canadian

Glass having a power factor less than .06 per cent, a dielectric constant of at least 7 and a softening temperature less than 625 C., which consists essentially of SiO_2, BaO, PhO, K_2O, Na_2O and Li_2O. No. 447,959. William Houston Armistead (to Corning Glass Works).

Translucent glass comprising 30 per cent to 60 per cent PbO, at least 18 per cent Al_2O_3, at least 5 per cent B_2O_3, and at least 10 per cent $SiiO_2$, which contains light diffusing crystallites of and aluminum borate. No. 448,123. William Houston Armstead (to Corning Glass Works).

Infrared transmitting glass which contains silica, alkali metal oxide, at least 2 per cent of zinc oxide and colouring materials consisting of 7 per cent to 2 per cent selenium, 1 per cent to 3 per cent cadmium sulphide, and 2 per cent to 3 per cent cobalt oxide. No. 448,124. Harrison P. Hood (to Corning Glass Works.)

Coatings

Treating oil selected from drying oils and semi-drying oils at temperature between 450° F. and 600° F., with boron trifluoride-bodied China-wood oil gel. No. 2,435,695. Charles J. Plank to Socony-Vacuum Oil Company, Incorp.

Film-forming composition for use in manufacture of oil-proof containers from paper, consisting of: algin selected from alginates of alkali metals, magnesium and ammonium; adhesion accelerator selected from sugars and solubilized starches; humectant selected from polyhydric alcohols, and water. No. 2,435,701. Vance V. Vallandigham to Kelco Company.

Coating siliceous base member comprises priming base member with invisible film comprising hydrolyzable organo-silicane, etc. No. 2,436,304. Oscar Kenneth Johannson to Corning Glass Works.

Coating ferrous metal articles with corrosion-resistant plastic. No. 2,436,420. Erith T. Clayton.

Coating water soluble polyvinyl alcohol film or sheet with solution of water-insoluble polyvinyl acetal resin as such, an aliphatic aldehyde containing not more than 4 carbon atoms, and acid catalyst in volatile organic solvent. No. 2,436,433. Walter John Jebens to E. I. du Pont de Nemours & Co.

Preparing improved drying oil comprises in combination, subjecting oil which contains polymerizable constituents to treatment for removal of at least part of nonpolymerizable constituents, etc. No. 2,437,343. Edward S. Barnitz to Distillation Products, Inc.

Making vitreous wet process porcelain insulators consists in forming mix of 26% ball clay, 20% flint, 32% feldspar, 22% china clay, and aluminum in finely divided form 1% by dry weight of the mix. No. 2,437,559. Davidge H. Rowland to The Porcelain Insulator Corporation.

Coating composition consisting of prolamine and N-butyl lactamide. No. 2,437,946. Cyril D. Evans and Ralph H. Manley.

Removal of paint, varnish and lacquer films from surfaces bearing films. No. 2,438,038. John Kenneth Craver to Monsanto Chemical Company.

Canadian

Dispersion of synthetic graphite in volatile liquid for coating surfaces by drying through volatilization. No. 22,985. Austin T. Collins, deceased to Miracle Lubricating Corp.

Bituminous material and a filler comprising precipitated calcium carbonate. No. 448,068. Sixteen Magnus Hjelte.

Dyestuffs

Production of illuminated discharge effects upon organic derivative of cellulose textile material dyed in dischargeable azo ground color. No. 2,435,658. George W. Seymour, George C. Ward, Robert L. Hunter to Celanese Corp. of America.

**U.S. Patents from Vol. 606, Nos. 2, 3, 4. Vol. 607, No. 1. Canadian from March 23-April 13.*

Electrolytically producing azo dyes on fibrous sheetmaterial and fibrous sheet material for process. No. 2,435,700. Myer Solomon to Radio Corporation of America.

Chain substituted cyanine dyes containing carbonyl and thiocarbonyl group. No. 2,435,865. Alfred W. Anish to General Aniline and Film Corporation.

Azo dyestuff represented by formula described in patent. No. 2,436,013. Mordecai Mendoza to Imperial Chemical Industries Limited.

Monoazo dye containing trifluoro acetylamino group. No. 2,436,-100. Joseph B. Dickey to Eastman Kodak Company.

Azo compounds having general formula described in patent. No. 2,436,115. James G. McNally and Joseph B. Dickey to Eastman Kodak Company.

Acyl substituted reactive methylene color couplers. No. 2,436,-130. Arnold Weissberger, Charles J. Kibler and Henry D. Porter to Eastman Kodak Company.

Disazo dyestuffs. No. 2,436,436. Arthur Howard Knight and William Elliot Stephen to Imperial Chemical Industries Limited.

Sulfofluorides of azoic dyestuffs. No. 2,436,697. Hans Zacharias Lecher, Robert Prescott Parker and Corris Mabelle Hofmann, to American Cyanamid Company.

Manufacture of new coloring matters of formula described in patent. No. 2,437,465. Eric Paul Goodings and Maurice Arthur Thorold to Imperial Chemical Industries Limited.

Dyestuff preparations containing acid ester salt of lueco vat dyestuff, water-soluble acid amide and salt of quaternary amino acid. No. 2,437,554. Roger Ratti and Philipp Brandt to Durand & Huguenin S. A.

Sulfofluorides of azoic dyestuffs. No. 2,437,644. Hans Zacharias Lecher, Robert Prescott Parker and Corris Mabelle Hofmann to American Cyanamid Company.

Metal complexes of pyrazolone azo dyestuffs. No. 2,437,645. Robert Sidney Long and Charles Edward Lewis to American Cyanamid Company.

Copper complexes of dianisidine disazo dyes. No. 2,437,699. Joseph Francis Laucius and Williams W. Williams to E. I. du Pont de Nemours & Company.

Diazotype layers containing resorcinol monoesters. No. 2,437,-868. William H. von Glahn and Lester N. Stanley to General Aniline & Film Corporation.

Canadian

Sulfur dye made by heating symmetrical compound represented by formulas described in patent. No. 22,983. Norman Hulton Haddock to Imperial Chemical Industries Limited.

Continuous process of dyeing textile fibres with vat dyes. No. 447,935. Nicholas Roderick Vieira (to Canadian Industries Ltd.)

Manufacture of stilbene dyestuffs by condensation of dinitrostilbene disulphonic acid, dinitrodibenzyl disulphonic acid or p-nitrotoluene sulphonic acid with aromatic compounds, which contain free amino groups, in presence of caustic alkalis. No. 448,295. Ernst Keller to J. R. Geigy A. G.

Manufacture of stilbene dyestuffs by condensation of dinitrostilbene disulphonic acid, dinitrodibenzyl disulphonic acid or p-nitrotoluene sulphonic acid with aromatic compounds, which contain free amino groups, in presence of caustic alkalis, the improvement wherein instead of up to two molecules of the known aromatic amino compounds there are used on one molecule of a compound selected from the group consisting of dinitrostilbene disulphonic acid, dinitrodibenzyl disulphonic acid and p-nitrotoluene sulphonic acid at least one molecule of an aminoaryltriazol of the benzene and naphthalene series. No. 448,296. Ernest Keller to J. R. Geigy, A. G.

Process for the manufacture of mordant dyestuffs of the 2-aryl-1:3-arylentriazole series. No. 448,297. Achille Conzetti and Otto Schmid to J. R. Geigy, A. G.

Equipment

Centrifuge for separating, from mixture of solids and liquids, heavier constituent-comprising liquid rich in solid particles and lighter constituents comprising liquid poor in solid particles. No. 2,435,623. Erik August Forsberg to Aktiebolaget Separator-Nobel.

Collapsible filter assembly. No. 2,435,627. James R. Grandin and Ernest F. Mechlin.

Producing lined pipe bends. No. 2,435,904. Stanley Robaus to Taylor Forge & Pipe Works.

Drying and disintegrating of gas-borne material. No. 2,435,927. Albert Harry Manning and Oswald Heller.

Making composite poppet valves comprises forming metal blank with reduced-diameter cylindrical end portion and flat shoulder at base of end portion, tightly fitting ring of corrosion-resistant metal onto reduced-diameter portion of blank, etc. No. 2,435,948. John Wischhusen to Thompson Products, Inc.

Portable liquid filtering apparatus. No. 2,436,077. Edwin A. Robertson to Titeflex, Inc.

Apparatus for determining rate of sedimentation of finely divided material. No. 2,436,083. John W. Williams and Edward M. Bevilacqua to The United States of America.

Apparatus for measuring penetrating radiations. No. 2,436,084. Barton L. Weller.

Photoelectric apparatus for spectrographic analysis. No. 2,436,-104. Aiken W. Fisher and William B. Warren to Fisher Scientific Company.

Explosion-proof swivel pipe joint. No. 2,436,127. Nils A. Tornblom to Appleton Electric Company.

Process for concentrating by freezing liquid fruit juice. No. 2,436,218. Wade E. Malcolm.

Apparatus for contacting solids with gaseous fluids. No. 2,436,-225. Henry J. Ogorzaly and Wilford P. Lakin to Standard Oil Development Company.

Pumping unit for mechanical lubricators. No. 2,436,492. Ralph H. Shapard to Nathan Manufacturing Company.

Microrefractometer for liquids. No. 2,436,567. Clark Webster Gould, Jr. to California Institute Research Foundation.

Slurry mixer. No. 2,436,626. William S. Whittle to The Ferro Engineering Company.

Liquid treatment tank with concentric compartments and with conduits below an inner bottom portion. No. 2,436,749. John Galandak and Ewald A. Kamp to Graver Tank & Mfg. Co.

Wash resistant filter media. No. 2,437,082. Herbert Leroy Davis and Lawrence R. B. Hervey to Johnson & Johnson.

Colloidal disc grinding mill for material fed thereto under pressure. No. 2,437,147. Ellsworth B. A. Zwoyer to Fuel Research Corporation.

Device for determining specific gravity of moving fluid. No 2,437,247. Kermit Fischer.

Apparatus for removing liquids from sheets of fibrous material. No. 2,437,254. John Stanley Hill to Masonite Corporation.

Densitometer comprising in combination support, two matched light sources mounted on support in spaced relation and shielded from one another; window disposed in path of rays of one light sources and over which photographic negative density of which is to be measured is adapted to be disposed for illumination, etc. No. 2,437,411. Clifton M. Tuttle to Eastman Kodak Company.

Method and apparatus for roentgenographic inspection. No. 2,437,472. John J. Moynihan to Joseph B. Brennan.

Actuating means for colorimetric apparatus. No. 2,437,550 William F. Peck, Kennard W. Harper and Roger S. Estey to American Optical Company.

Means for separating dust from stream of gas. No. 2,437,592. Richard E. Brown to Air-Maze Corporation.

Measuring oxygen content of gas sample comprises mixing the sample with combustible gas, burning mixture in air, and measuring temperature of flame. No. 2,437,720. Robert A. Ackley to Republic Flow Meters Company.

Gas mask comprising flexible fabric hood including head portion and adjustable metal head frame. No. 2,437,755. Carl Rich.

Optical micrometer for measuring thickness of transparent or translucent bodies. No. 2,437,775. William Ewart Williams.

Canadian

Liquid level gauge in which the electrical capacity of a condenser is varied by the rise and fall of the liquid. No. 447,911. Stanley James Smith.

Temperature control device for controlling a flowing fluid. No. 447,921. James R. Campbell (to Canadian General Electric Co., Ltd.)

Pump structure comprising a housing having a chamber therein, pumping means in said chamber comprising inner and outer eccentric rotor members having inter-engaging teeth forming pumping chambers between them. 447,963. George Frederic Bunte (to Eaton Mfg. Co.)

Fractionating plate construction. No. 447,991. Pierre Lambert, Ralph Henry Riemenschneider and John Alexander Gibb (to Lummus Co.)

Combined hydraulic motor and pump unit. No. 447,999. Cyril Alphonso Pugh, and Albert Henry James Thomas (to Plessey Co.)

Pump comprising an annular flow passage between a central core and en enclosing casing, and a rotor having blades which act on the fluid in a divergent portion of the flow passage, the central core being constituted in part by a boss which arries the rotor blades and having a surface conforming substantially to a surface of revolution of "dolphin" shape. No. 448,066. James Herbert Wainwright Gill.

Rotary gear pump coupling. No. 448,010. John R. Albright (to Geo. D. Roper Corp.)

Positive displacement rotary pump. No. 448,175. Augustus C. Durdin (Geo. D. Roper Corp.)

Pump comprising a pump shaft, an electric motor having its rotor mounted on the pump shaft, a plurality of stages of impellers mounted on said shaft, a casing for said pump enclosing the motor and impellers and having an axial inlet opening at one end for liquid to be pumped, said motor being disposed between different stages of impellers, and passages in said casings conducting the liquid longitudinally on the outside of the motor and radially inward from all sides to the next adjacent impeller to provide an axial inlet therefor free from turbulence. 448,180. 448,180. Anatol J. Harlamoff (A. O. Smith Corp.)

Fluid flow control device. 448,212. Herman R. Miller (to Wingfoot Corp.)

A compound pumping circuit comprising a multiple of interconnecting pumps and combined pressure responsive valve means therefor providing for either series or parallel operation and for limiting the output pressure of one of the pumps. No. 448,286. Walter Ross Eames to Eaton Mfg. Co.

Pipe joint. No. 448,317. Frederick W. Blanchard to T. McAvity & Sons Limited.

Apparatus for countercurrently contacting two liquids. No. 448,346. Theodore W. Rosebaugh to Shell Development Company.

Filter. No. 448,377. Southwick Walbridge.

Rotary Compressor. No. 448,382. Thomas L. Hicks.

Connector for pressure lines. No. 448,390. Eric Herbert Scovell

Instrument for measuring wall thickness comprising an electromagnetic gauge. No. 448,411. Henry J. Look to Bohn Aluminum & Brass Corporation.

Condensation pump. No. 448,431. George A. Kuipers to Distillation Products, Inc.

In a heat exchange device the combination, with a matrix or core comprising a plurality of thin-walled heat exchange elements, and a pair of substantially rectanguler header-plate frames. No. 448,445. Clifford Stuart Steadman and John Louis Coltman to Imperial Chemical Industries Limited.

Valve comprising in combination a hard metal seating piece provided with an orifice, an axially bored nippel to one end of which the seating piece is secured, shaped to provide around the seating piece an annular and notched shield, and a closure member to sit on both the shield and setting piece. No. 448,450. Richard Joseph Ifield and Ernest Ansley Watson to Joseph Lucas Limited.

Heat exchanger fin-tube. No. 448,458. Frederick T. Elder to Montreal Locomotive Works Limited.

Electronic level control. No. 448,465. John A. Long to Photoswitch Incorporated.

Explosives

Method of filling shell with molten explosive charge which su-

lidifies upon cooling and which has greater density in solid state than in molten state. No. 2,435,610. Charles F. Schneider.

Process for preparation of dipentaerythritol hexanitrate. No. 2,437,582. Joseph A. Wyler to Trojan Powder Company.

Blending smokeless powder grains. No. 2,437,694. Clarence N. Hickman.

Canadian

Blasting cap comprising a base charge and a single superposed charge comprising a free-flowing composition of diazodinitrophenol intermingled with a solid nitrated polyhydric alcohol of the formula $C_nH_{n+2}O_H$. No. 447,927. Lawton Arthur Burrows (to Canadian Industries Ltd.)

Food

Separating solid crystals from glyceridic oil. No. 2,435,626. Chester M. Gooding and John R. Rich to The Best Foods, Inc.

Aqueous flavoring solution for imparting flavors to beverages and edibles, comprising 25% of lauryl meta sodium sulfobenzoate, 30% of citrous oil, 10% of propylene glycol, 10% of ethyl alcohol, balance water. No. 2,435,744. Carlisle G. Hartman.

Centrifuge for separation of cheese constituents from whey or serum of higher specific gravity. No. 2,436,498. George J. Strezynski to The De Laval Separator Company.

Producing cereal starch from unsteeped grain. No. 2,437,036. Harvey K. Murer and William A. Mitchell to General Foods Corporation.

Producing dry, water-soluble, fruit juice concentrate, comprises admixing calcium-bearing phytate in fruit juice containing citric or malic acids. No. 2,437,104. Royal Lee to Lee Foundation for Nutritional Research.

Canadian

Preventing butyric acid fermentation in cheeses by adding a member selected from the group consisting of an alkali-metal chlorate, an alkaline earth metal chlorate, and mixtures thereof. No. 447,913. Artturi Ilmari Virtanen.

A method of rendering soluble powdered pectin dispersible in water. No. 448,439. Aksel G. Olsen to General Foods Corporation.

Inorganic

Producing sulfur dioxide from waste sulfuric acid produced in treatment of hydrocarbons and which contains substantial amounts of hydrocarbon material. No. 2,435,710. Robert T. Collier and John G. Carriere to Union Oil Company of California.

Removing elemental sulfur and organic polysulfides containing more than two sulfur atoms per molecule, from hydrocarbon liquid comprising contacting liquid with alkali metal stannite solution until sulfur is removed and polysulfides are converted to mercaptans. No. 2,435,732. George W. Ayers and Priscilla Lyon to The Pure Oil Company.

Producing sulphate of ammonia from distillation gases passed into scrubbing contact with bath liquor through cracker pipe. No. 2,435,898. Carl Otto to Fuel Refining Corporation.

Homogeneous prepared starch for use on textiles, comprising semi-liquid dispersion of starch, sodium benzoate, reaction producte of stearic acid and excess of triethanolamine formed in situ and zinc stereate. No. 2,435,901. Allen F. Peters.

Catalyst suitable for converting ethanol to butadiene consists of mixture of silica and oxide from group consisting of zirconium and thorium oxides. No. 2,436,125. Le Roy U. Spence and Darrel J. Butterbaugh and Donald G. Kundiger to Röhm & Haas Company.

Generation of chlorine dioxide comprises contacting chlorite with organic acid anhydride. No. 2,436,134. Royden N. Aston to The Mathieson Alkali Works, Inc.

Composition of matter in solid form comprising solid, water-soluble deliquescent, crystallizable inorganic salt capable of lowering freezing point of water, organic hygroscopic, normally solid, non-deliquescent colloid, capable of forming gel with water, in finely divided form, etc. No. 2,436,146. Werner E. Kleinicke to The Johnson-March Corporation.

Apparatus for treating inorganic oxide hydrosol to thicken same. No. 2,436,403. Howard H. Reynolds to Davison Chemical Corporation.

Portable unit for storing liquid phase oxygen and controlling its conversion into gas oxygen. No. 2,436,411. John A. Weaver.

Producing hydrochloric acid from hydrogen chloride and water. No. 2,436,432. Frederick L. Hunter to Fansteel Metallurgical Corporation.

Obtaining insoluble, solid apparently crystalline of trivalent metal from crystalline alum containing trivalent metal as part of its crystalline structure. No. 2,436,509. Charles L. Faust to Reconstruction Finance Corporation.

Producing catalysts containing barium peroxide. No. 2,436,558. Kenneth C. Edson and Frank E. Fisher to Skelly Oil Company.

Manufacture of sulfamic acid from reactants, liquid sulfur trioxide and the product obtained by bringing together urea and sulfuric acid in equimolecular quantities. No. 2,436,658. Howard S. McQuaid to E. I. du Pont de Nemours & Co.

Manufacturing crystalline trisodium phosphate of predetermined bulk density and having predetermined length to diameter ratio of individual crystals. No. 2,436,670. Cecil H. Russell to Monsanto Chemical Company.

Composition of matter dehydrogenation catalyst consisting of mixture of zinc oxide and 1-6% Bi_2O_3. No. 2,436,733. Helmuth G. Schneider and Vincent F. Mistretta to Standard Oil Development Company.

Precipitation of basic calcium hypochlorite. No. 2,436,745. Richard W. Darbyshire to Wyandotte Chemicals Corporation.

Obtaining alumina from potassium alum, includes forming melt of alum hydrate, dispersing water-soluble inorganic sodium salt in alum melt, adding anhydrous seeds of solidified melt comprising mixture of alum and water-soluble inorganic so-

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dium salt, dehydrating mixture, calcining dehydrated product. No. 2,436,778. Henry A. Pray, Charles L. Faust and Frederic C. Jelen to Reconstruction Finance Corporation.

Regenerating granular form solid which has been used as a hydrocarbon conversion catalyst and is contaminated by carbonaceous deposit. No. 2,436,780. Thomas P. Simpson to Socony-Vacuum Oil Company.

Regeneration of subdivided silica-alumina catalyst particles contaminated with combustible deposit wherein catalyst is regenerated by passing oxygen-containing gas upwardly through mass of contaminated particles in regeneration zone, etc. No. 2,436,927. Louis S. Kassel to Universal Oil Products Company.

Method of regenerating chromic acid anodizing solution. No. 2,436,940. Joseph Schulein.

Composition of matter, a catalyst bonded on ferrous metal support by an oxide of iron, catalyst being a mixture of zinc oxide and 1-6% of bismuth oxide. No. 2,436,970. Vincent F. Mistretta to Standard Oil Development Company.

Preparing potassium stannate comprises adding to impure tin compound caustic potash in presence of water to form at least colloidal solution of tin values, etc. No. 2,436,974. Hartmut W. Richter to Metal & Thermitt Corporation.

Improving grinding and air classification of beach sand Indian ilmenite preparatory to its acid attack to form soluble titanium compounds therefrom, comprises mixing on ilmenite basis .02% to .2% of naphthenic acid with said ilmenite, etc. No. 2,437,164. Edward N. Kramer to E. I. du Pont de Nemours & Company.

Composite titanium dioxide-metal oxide pigment. No. 2,437,171. Alphonse Pechukas to Pittsburgh Plate Glass Company.

Producing highly-absorbent, active carbon in sheeted form comprising impregnating sheeted, cellulosic material with solution of boron compound selected from boric acid and compounds which on ignition yield boric acid until 1-15% of boron compound is impregnated, igniting material impregnated to burn in excess of air, water extracting residual boron compounds from resulting active carbon product. No. 2,437,174. Frank Kerr Signaigo to E. I. du Pont de Nemours & Company.

Potassium sulphate manufacture. No. 2,437,182. James A. Barr and William A. Smith to International Minerals & Chemical Corporation.

Recovering anhydrous hydrogen chloride from aqueous solution thereof. No. 2,437,290. Kenneth C. Bottenberg and James A. Richardson to Phillips Petroleum Company.

Reducing metal oxide catalyst in which metal oxide is oxide of metal selected from cobalt and nickel to produce reduced metal oxide catalyst for catalysis of direct reaction between ammonia and olefins to produce nitrogen-containing products. No. 2,437,487. John W. Teter to Sinclair Refining Company.

Removing ferrous chloride from surface of steel comprises passing steel through bath of molten lead at temperature above freezing temperature of chloride whereby to remove chloride from steel by flotation. No. 2,437,528. Ralph W. Hodil to Surface Combustion Corporation.

Catalyst comprising 80 to 99% by weight of carrier, balance being catalytic agent distended on carrier, carrier consisting of activated alumina gel containing between 1% and 15% of silica precipitated in presence of entire hydrous precipitated alumina gel, catalytic agent comprising oxide of metal selected from related metals which have their differentiating electron in second from outermost shell. No. 2,437,533. Hal C. Huffman to Union Oil Company of California.

Making selenium units. No. 2,437,995. Wayne E. Blackburn to Westinghouse Electric Corporation.

Production of salts of mono-organo silanols. No. 2,438,055. James Franklin Hyde and Oscar Kenneth Johannson to Corning Glass Works.

Canadian

Crystals of ammonium nitrate by crystallization from an aqueous solution, followed by separation from the mother liquid, the steps of producing a magma containing at least 30 per cent by weight of ammonium nitrate crystals in a vacuum evaporator and applying shear stress to the magma to decrease its viscosity so that it can be readily handled. No. 447,928. Frederick James Wilkins (to Canadian Industries, Ltd.)

Manufacture of sodium tripolyphosphate by forming a solution in water of material providing at least 5 moles and less than 6 moles of Na_2O and 3 moles of P_2O_5. No. 448,105. Charles S. King (to Blockson Chemical Co.)

Producing a form of sodium triphosphate having greater immediate solubility and higher molecular weight in terms of $Na_5P_3O_{10}$ than has the compound $Na_5P_3O_{10}6H_2O$ which comprises flash-drying finely divided aqueous solution containing at least one compound of Na_2O and at least another compound of P_2O_5 all of said compounds being present in quantity to provide material in the proportion of 5 moles of Na_2O to 3 moles of P_2O_5. No. 448,106. Charles S. King (to Blockson Chemical Co.)

Producing an adsorbent composition which comprises reacting in aqueous solution an alkali metal silicate and a water-soluble salt of magnesium in the presence NH_4+ions and separating the insoluble magnesium silicate from said solution. No. 448,252. William A. LaLande, Jr. to Attapulgus Clay Company.

The process which comprises introducing phosgene into a suspension of 4,4'-diamino-diphenylsulphone-dihydrochloride in ortho-dichlorbenzene until the 4,4'-diamino-diphenyl-sulphone-dihydrochloride has completely dissolved while heating the mixture to produce diphenyl-sulphone-4,4'-di-isocyanate. No. 448,366. Paul Pohls and Fritz Mietzsch (to Winthrop Chemicals Co.)

Process of working up refractory magnesia-providing rock. No. 448,403. Robert A. Schoenlaub to Basic Refractories, Inc.

In a cyclic process for the manufacture of sodium percarbonate by reacting sodium carbonate and hydrogen peroxide the improvement which consists in adding hydrogen peroxide and sodium carbonate to a mother liquor from a previous precipitation. No. 448,448. Victor Wallace Slater and William Stanley Wood to B. Laporte Limited.

Metals, Ores

Preparing phosphorilated thiamin. No. 2,435,750. Ben Maizel and Irving Gerson to Vico Products Company.

Preparing nicotinamide. No. 2,435,809. Jacob van de Kamp and Max Ishler to Merck & Co., Inc.

Synthesizing thyroxine from diiodtyrosine comprising steps of incubating diiodotyrosine in alkaline solution with aeration at 50° to 70° C. No. 2,435,947. Charles W. Turner and Ezra P. Reineke to American Dairies Incorporated.

Preparation effective in active immunization against scarlet fever comprising tannic acid precipitated hemolytic streptococcus toxin and aluminum hydroxide. No. 2,436,063. John N. Adam, Jr. and Olive Durfee to American Cyanamid Company.

Therapeutic and prophylactic composition for use in contact with delicate living tissues adapted when in contact with aqueous medium, to evolve free oxygen, comprising 100 parts of zinc peroxide intimately mixed with between 5 and 15 parts of calcium peroxide. No. 2,436,673. Robert S. Shelton to The Wm. S. Merrell Company.

Rendering vitamin B_1 preparations soluble in oils and other nonpolar solvents comprises coupling water-soluble salt of thiamin selected from thiamin chloride hydrochloride, thiamin bromide hydrobromide, and thiamin sulfate with alkali metal salt of dioctylsulfosuccinic acid. No. 2,437,504. John B. Conn to Merck & Co.

Preparing therapeutic injection and infusion fluids comprises subjecting to partial acid hydrolysis water soluble polysaccharide, selected from dextran, levulan and galactan under conditions producing hydrolytic products completely soluble in water, etc. No. 2,437,518. Anders Johan Troed Grönwall and Björn Gustaf-Adolf Ingelman to Aktiebolaget Pharmacia.

Canadian

Manufacture of therapeutic compounds which comprises preparing sulphonic acid amide compounds by reacting upon a paramino-benzene sulphonic acid amide with an aryl compound. No. 448,493. Robert Behnisch, Joseph Klarer and Fritz Mietzsch to Winthrop Chamical Company, Inc.

Medicinal

Weather-resistant mild steel free from air hardenability, consisting of chromium ferrite and chromium pearlite. No. 2,435,624. Russell Franks to Electro Metallurgical Company.

Manufacture of metallurgical charcoal from comminuted wood waste material. No. 2,435,825. Worth C. Goss.

Decarburizing austenitic manganese cast iron. No. 2,435,946. Alfred Gordon Evans Robiette and Peter Francis Hancock to Birlec Limited.

Electroplating bath for depositing bright silvery alloy plate of 50% to 75% copper, 15% to 30% tin and 5% to 20% zinc. No. 2,435,967. George W. Jernstedt to Westinghouse Electric Corporation.

Thermally working mineral and like masses comprising separating and removing material from such mass by applying an oxy-fuel flame comminuted flux-forming fuel. No. 2,436,001. John M. Gaines, Jr. to The Linde Air Products Company.

Flux-forming fuel and method for thermally working minerals therewith. No. 2,436,002. Virgil C. Williams to The Linde Air Products Company.

Recovering metallic tin and antimony-tin alloy from Sb-Sn-As bearing materials. No. 2,436,010. Yurii E. Lebedeff to American Smelting and Refining Company.

Producing magnesium base alloys of fine grain structure comprises melting magnesium base alloy treating molten alloy with hydrocarbon in which carbon is released in active form at temperature of treatment. No. 2,436,520. Charles H. Mahoney, Harley C. Lee, Allan L. Tarr and Pierre E. Le Grand to Reconstruction Finance Corporation.

Nickel plating solution consisting of water from 200 to 400 grams per liter of source of nickel of the class consisting of nickel chloride and nickel chloride plus nickel sulfate. No. 2,436,690. Arthur H. DuRose to The Harshaw Chemical Company.

Recovering tin from stannic chloride comprises establishing molten bath of tin, introducing anhydrous liquid stannic chloride into contact with tin to produce gaseous tin chloride, reacting tin chloride with pieces of aluminum in solid state to effect reduction of tin chloride to tin metal. No. 2,436,868. Yurii E. Lebedeff to American Smelting and Refining Company.

Improvement in nitriding of ferrous metal comprises treating metal in batch or discontinuous operation and while heated to temperature within nitride hardening temperature range, with dry gaseous mixture of ammonia, etc. No. 2,437,249. Carl F. Floe to The Nitralloy Corporation.

Heat treating permanent magnet alloy consisting of 20-85% copper, 10-50% nickel, 5-70% cobalt. No. 2,437,563. John D. Seaver to General Electric Company.

Electrolytically zinc plating magnesium and magnesium base alloys. No. 2,437,612. Hans Osborg.

Production of metallic magnesium. No. 2,437,815. Fritz J. Hansgirg to The Permanente Metals Corporation.

Method of depositing copper by the bath having pH between 6.5 and 7.5, and consists of bivalent copper, pyrophosphate (P_2O_7), and nitrate (NO_3). No. 2,437,865. Jesse E. Stareck to United Chromium, Incorporated.

Purifying sulphidic tungsten ore concentrate containing bismuth sulphide. No. 2,437,870. Thomas Jefferson Williams.

Improving adherence of aluminum coatings. No. 2,437,919. Kasimir Oganowski to The American Rolling Mill Company.

Canadian

Separation of nickel, together with cobalt and copper when associated therewith, from ores containing a relatively high percentage of iron, which comprises reduction of the oxides of nickel, cobalt and copper, but not the oxide of iron, substantially to the metallic state and subjecting the reduced ore to an aqueous solution which contains hypochlorous acid. No. 448,073. Alan Kissock.

Alloy of about 40 per cent silver, about 10 per cent copper, and zinc and cadmium in a total amount of about 50 per cent, with a zinc-cadmium ratio of about 0.85. No. 448,142. Robert H. Leach (to Handy & Harman).

Applying a protective coating to an aluminum or aluminum alloy surface which comprises contacting the surface with a hot aqueous solution containing effective concentrations of an alkali metal chlorite, an alkaline metal chromate and alkali metal carbonate. No. 448,288. Walter R. Meyer to The Enthone Company.

An alloy containing 15 to 37-5 per cent zinc, 7.5 to 30 per cent manganese, 0-05 to 2 per cent aluminum, 0.1 to 4 per cent iron and not less than 50 per cent copper. No. 448,325. John L. Rodda to The New Jersey Zinc Company.

Alpha copper brass alloy composed of copper, zinc and columbium. No. 448,433. Alan U. Seybolt to Electro Metallurgical Company.

Organic

Nitrosyl-halide addition product of allyl-type olefinis higher hydrocarbons. No. 2,435,570. Leland James Beckham to Allied Chemical & Dye Corporation.

Quaternary ammonium compounds having general formula described in patent. No. 2,435,583. William S. Gump to Burton T. Bush, Inc.

Making bis-(3, 5, 6-tri-chloro-2-hydroxyphenyl) methane. No. 2,435,593. Max Luthy and Williams S. Gump to Burton T. Bush, Inc.

Purifying hydrocarbon material containing organic halogen compounds as impurities. No. 2,435,621. John W. Brooks and James B. Kirkpatrick to Socony-Vacuum Oil Company, Incorp.

High molecular weight auto-condensation product of an acid amide. No. 2,435,631. Eugene Lieber to Standard Oil Development Company.

Recovering pyridine compounds from vaporous products produced in distillation of bituminous coal in by-product coke plants. No. 2,435,663. Joseph H. Wells and Philip J. Wilson, Jr. to Carnegie Illinois Steel Corporation.

Isomerization of alicylic hydrocarbon selected from alkylcyclopentanes, cyclohexane, alkylcyclohexanes, cycloheptane and alkylcycloheptanes. No. 2,435,691. Claude G. Meyers and Alexander N. Sachanen to Socony-Vacuum Oil Company, Inc.

Obtaining increased flow of oleoresins and gums from coniferous trees comprising applying, to wounds in bark, plant-growth regulator taken from group consisting of substituted aromatics. No. 2,435,724. Carl E. Ostrom and Clifford S. Schopmeyer.

Hydrolyzing fats by causing fatty matter and water to flow countercurrently in direct contact in autoclave under high temperature and pressure. No. 2,435,745. Martin Hill Ittner to Colgate-Palmolive-Peet Company.

Thermal conversion of hydrocarbons promoted by explosive organic nitrogen compounds. No. 2,435,760. Carlisle M. Thacker and Hillis O. Folkins to The Pure Oil Company.

Alkylating paraffin hydrocarbons by means of compound selected from olefins and alkyl chlorides. No. 2,435,761. Carlisle M. Thacker to The Pure Oil Company.

Controlled oxidation of organic compounds to produce oxygenated compounds having at least same number of carbon atoms per molecule as starting organic compound. No. 2,435,763. William E. Vaughan and Edward R. Bell to Shell Development Company.

Separating para-xylene from mixture therewith meta-xylene. No. 2,435,792. Edward H. McArdle and David M. Mason to Standard Oil Development Company.

Alpha-hydroxy-ether of fatty acid. No. 2,435,828. Herbert H. Guest to The J. B. Williams Company.

Alpha-hydroxy-ether of fatty acid soap. No. 2,435,829. Herbert H. Guest to The J. B. Williams Company.

Oxidation of alkyl esters of abietic acid. No. 2,435,831. Mortimer T. Harvey to Harvel Research Corporation.

Cyanoethylated formals and method for preparation. No. 2,435,869. Herman A. Bruson and Thomas W. Riener to The Resinous Products & Chemical Company.

Stabilization of chlorinated ethyl-benzene by basic anion exchange agents. No. 2,435,887. Herbert G. Hornbacher & William C. Bauman to The Dow Chemical Company.

Glycerol phosphoric acid salts of basic dyes selected from basic diaryl methane, azine, oxazine, thiazone, azo-azine, azo and acridine dyes, said salts being easily soluble in water and ethanol. No. 2,435,905. Arthur E. Schaefer to General Aniline & Film Corporation.

P-aminobenzene sulfonamides. No. 435,974. Henry Martin, Hans Gysin, Otto Neracher and Rudolf Hirt to J. R. Geigy A. G.

Producing alkyl cycloalkyl halide comprises condensing tertiary alkyl halide and cyclo-olefin in presence of Friedel-Crafts metal halide catalyst at —40° C. to +50° C., halogen being selected from chlorine and bromine. No. 2,436,058. Louis Schmerling to Universal Oil Products Company.

Sulfonamide derivatives. No. 2,436,062. Philip S. Winnek to American Cyanamid Company.

Synthesis of substituted pteridins. No. 2,436,073. John M. Mowat to American Cyanamid Company.

Process of preparing carboxypyrimido pyrazines. No. 2,436,074. John H. Mowat and James H. Boothe to American Cyanamid Company.

Mixture obtained by admixing chlorine in presence of light with carbon tetrachloride solution of tetrafluoroethylene/n-butane reaction product. No. 2,436,135. Paul L. Barrick and Robert E. Christ to E. I. du Pont de Nemours & Company.

Preparation in closed system, of aliphatic dithiols. No. 2,436,137. Charles Bedford Biswell to E. I. du Pont de Nemours & Company.

Dialkyl esters of long-chain alkylphosphonates. No. 2,436,141. Max T. Goebel to E. I. du Pont de Nemours & Company.

Obtaining monomeric polyfluorocyclobutene comprises dechlorinating monomeric polychloropolyfluorocyclobutane. No. 2,436,142. Jesse Harmon to E. I. du Pont de Nemours & Company.

Preparation of fluoroalkanes having at least two fluorine atoms attached to terminal carbon atom. No. 2,436,143. Harvey H. Hoehn to E. I. du Pont de Nemours & Company.

Vinyl fluoroacetates and polymers derived therefrom. No. 2,436,144. Benjamin W. Howk and Ralph A. Jacobsen to E. I. du Pont de Nemours & Company.

Separating and concentrating diolefin from mixture of hydrocarbons. No. 2,436,149. Nicholas Menshih to Standard Oil Development Company.

Alkylation of aromatic hydrocarbons by contact with heat-stable metal halide catalysts. No. 2,436,151. Arlie A. O'Kelly and Robert H. Work to Socony-Vacuum Oil Company, Incorp.

Converting isolated mass consisting of compound selected from isodehydrocholesterol and its esters into provitamin material. No. 2,436,195. James Allan Callan to E. I. du Pont de Nemours & Co.

Preparing monomeric dithioglycidol comprises heating 1,2-dithioglycerol at pressure of 5-25mm. to between 100° C. and boiling point. No. 2,436,233. Frank Kerr Signaigo to E. I. du Pont de Nemours & Company.

Purification of organic nirtosation-sulfitation products. No. 2,436,243. Leland James Beckham to Allied Chemical & Dye Corporation.

Production of alpha, omega-dicarboxylic acids. No. 2,436,269. Samuel L. Scott to E. I. du Pont de Nemours & Company.

Polyiodo diaryl aliphatic acids and process for manufacture. No. 2,436,270. Erwin Schwenk and Domenick Papa to Schering Corporation.

Making alkoxy-substituted carboxylic acid esters by combining ketene with a compound of group consisting of symmetrical formals and symmetrical acetals. No. 2,436,286. Richard Ensign Brooks to E. I. du Pont de Nemours & Company.

Production of formaldehyde by catalytic oxidation of methanol. No. 2,436,287. Willis Frank Brondyke and Joseph Armand Monier, Jr. to E. I. du Pont de Nemours & Company.

Process for preparation of ethyleneurea comprises subjecting urea at pressure from 10 atmospheres upward to reaction with substituted ethane. No. 2,436,311. Alfred T. Larsen, Donald J. Loder and Harry R. Dittmar to E. I. du Pont de Nemours & Company.

Fluorination of hexachlorobutadiene. No. 2,436,357. Carl I. Gochenour and Glendon D. Kyker to Hooker Electrochemical Company.

Producing increased production of oleoresins and gums in coniferous treewood comprising wounding coniferous bark and living sapwood, applying to wound species of Fusarium fungus present in pitchy cankers of Pinus virginiana Mill. No. 2,436,359. George H. Hepting.

Producing 2-amino-5-halo-genpyrimidine. No. 2,436,360. Martin Everett Hultquist to American Cyanamid Company.

New composition of matter 3-chloro-6-ethylolaminophthalethylolimide. No. 2,436,362. Harold T. Lacey and Robert E. Brouillard to American Cyanamid Company.

Photochemical vapor phase chlorination of paraffinic hydrocarbons of three to seven carbon atoms. No. 2,436,366. James S. Sconce and Arnold N. Johnson to Hooker Electrochemical Company.

Continuous liquid phase stepwise process for isomerizing at least one normal paraffin hydrocarbon containing at least four carbon atoms per molecule in presence of aluminum bromide catalyst. No. 2,436,367. Will Swerdloff to Socony-Vacuum Oil Company.

Catalytic hydrogenation of aminoacetonitrile to ethylene diamine. No. 2,436,368. Arthur G. Werber and Clarence D. Bell to E. I. du Pont de Nemours & Company.

New compound, delta^2-tetrahydrobenzaldol. No. 2,436,416. Joseph E. Bludworth and Donald P. Easter to Celanese Corporation of America.

Quaternary ammonium salts of dibenzthiazyl azo benzenes. No. 2,436,428. Norman Hulton Haddock and Clifford Wood to Imperial Chemical Industries Limited.

Production of alkyl aromatic hydrocarbons. No. 2,436,480. Julian M. Mavity to Universal Oil Products Company.

Reacting naphthenic hydrocarbon with halo-olefin in presence of Friedel-Carfts metal halide catalyst at —30° C. to 25° C. No. 2,436,490. Louis Schmerling to Universal Oil Products Company.

Reacting naphthenic hydrocarbon with halo-olefin in presence of halide catalyst of Friedel-Crafts type subjecting resultant halonaphthene to dehydrohalogenation to yield unsaturated compound. No. 2,436,491. Louis Schmerling to Universal Oil Products Company.

Recovering furfural from admixture with foam producing oils which are not readily removed from furfural by distillation. No. 2,436,502. Charles Keith Buell and Charles F. Weinaug to Phillips Petroleum Company.

Making 4-keto pimelic acid in which furfural is reacted with fused sodium acetate and acetic anhydride. No. 2,436,532. Fred G. Singetone to H. H. Robertson Company.

Improved process for making olefin chlorohydrins comprises reacting chlorine with olefin in presence of 20-80% by weight aqueous solution of sulfuric acid, separating HCl from reaction mixture, separating olefin chlorohydrin at temperature below its decomposition temperature. No. 2,436,591. Charles E. Morrell, James K. Small and Howard L. Yowell to Standard Oil Development Company.

Dehydrogenating hydrocarbon selected from mono-olefins containing at least 4 carbon atoms to molecule and cyclic hydrocarbons containing benzene nucleus and at least two carbon atoms in alkyl substituent group. No. 2,436,616. Simpson D. Sumerford to Standard Oil Development Company.

Production of 2,3-dihydropyran-5-carboxylic acid. No. 2,436,645. Peter A. Hawkins and Nicholas Bennett to Imperial Chemical Industries Limited.

Producing d-saccharic acid comprising gradually adding d-glucose to nitric acid, maintaining temperature 55° to 90° C. No. 2,436,659. Charles L. Mehltretter.

Oxidation of an N-heteroaryl compound having oxidizable organic grouping attached to nitrogen-containing aromatic nucleus by one or more carbon-to-carbon linkages to compound containing pyridine carboxylic acid radical. No. 2,436,660. Max B. Mueller to Allied Chemical & Dye Corporation.

Acetylene generator. No. 2,436,674. Carl F. Smith to The Sight Feed Generator Company.

Preparing N-substituted piperazines. No. 2,436,685. Richard Baltzly and Emil Lorz to Burroughs Wellcome Co. (U.S.A.).

Alkylation of isobutane with butene. No. 2,436,695. Carl S. Kuhn, Jr. to Socony-Vacuum Oil Company Incorporated.

Separation of olefins of from 3 to 5 carbon atoms from close-boiling paraffins and for separately recovering olefins and said paraffins. No. 2,436,698. Alex G. Oblad to Socony-Vacuum Oil Company.

Carbobenzoxyaminoethyl ester of diacylglycerophosphoric acid wherein acyl radicals are aliphatic and contain at least 8 carbon atoms. No. 2,436,699. William Gordon Rose.

Preparing vinyl chloride by reacting acetylene with hydrogen chloride in vapor phase in presence of catalyst comprising as essential component trivalent arsenic compound in which at least one valence of arsenic is satisfied by betachlorovinyl group, remaining valences being satisfied by chlorine, and activated charcoal as carrier therefor. No. 2,436,710. James A. Bralley to The B. F. Goodrich Company.

Preparation of vinyl chloride. No. 2,436,711. James A. Bralley to B. F. Goodrich Company.

Dehydrogenating butane. No. 2,436,721. Kenneth C. Laughlin and Henry J. Ogorzaly to Standard Oil Development Company.

Method of making 3,6-bis-(beta-hydroxy-ethyl)-2,5-diketopiperazine. No. 2,436,739. Edgar C. Britton and John E. Lival to The Dow Chemical Company.

Stabilizing furan comprises incorporating therein 0.01 to 1.0% of pyridine by weight. No. 2,436,764. Harry B. Copelin to E. I. du Pont de Nemours & Company.

Continuously forming pellets of phthalic anhydride and like substances having sharp crystallizing point. No. 2,436,766. Walter M. Davis to Monsanto Chemical Company.

Dehydration of beta-hydroxy-alkyl cyanide to form alkenyl cyanide. No. 2,436,774. Howard S. Nutting and Arthur R. Sexton to The Dow Chemical Company.

Organofluorosilanes and method of making same. No. 2,436,777. Donald E. Pletcher and Howard S. Nutting to The Dow Chemical Company.

Triamino propanes. No. 2,436,779. Murray Senkus to Commercial Solvents Corporation.

Manufacturing furfural and organic acids from material from which furfural, acetic and formic acids can be produced. No. 2,436,804. John Stanley Hill to Masonite Corporation.

Ortho-tolidine tablet composition to be used in determining residual chlorine content of water sample. No. 2,436,814. James L. Leitch.

Stabilization of tetraalkyl lead and compositions containing same. No. 2,436,838. Harold Von Bramer and Albert C. Rugles to Eastman Kodak Company.

2-substituted-3, 4-ureyline-dihydrothiophenes the 2-substituent being member of group consisting of —COOH, —CN, —CO alkyl, —CO carboxyalkyl and the lactine thereof. No. 2,436,851. Albert Businger, to Hoffmann-La Roche Inc.

Synthesis of 1,2-dihydronaphthalene from solutions containing alpha tetralol. No. 2,436,864. Robert Johnson to Koppers Company, Inc.

Derivatives of 3-oxo-4-hydroxythiophan and process for manufacture. No. 2,436,865. Paul Karrer to Hoffmann-La Roche Inc.

Producing chlorine by reacting hydrogen chloride with metal oxide and reacting metal chloride so formed with oxygen-containing gas to release chlorine and reform metal oxide. No. 2,436,870. Eger V. Murphree to Standard Oil Development Company.

Producing naphthalene comprises reacting charging stock comprising mono-ethylbenzene at 525° to 700° C. and liquid hourly space velocity of from 0.1 to 3.0 in presence of synthetically prepared catalyst comprising silica and at least one metal oxide selected from alumina, thoria, and zirconia. No. 2,436,932. William J. Mattox to Universal Oil Products Company.

Alkylating isoparaffins with olefins. No. 2,436,965. Karl Korpl and Arthur R. Goldsby to The Texas Company.

Ether-esters of organic hydroxy diphenyl acetic acid and process for manufacture. No. 2,437,035. Alexander Lang Morrison and Marianne Königstein to Hoffmann-La Roche, Inc.

Glyceride oil refining with foots softening agent. No. 2,437,075. Benjamin Clayton to Benjamin Clayton doing business as Refining Unincorporated.

Synthesizing vinyl fluoride comprises subjecting in vapor phase and at 20° C. to 150° C., acetylenic hydrocarbon in admixture with hydrogen fluoride to contact with catalytic composition consisting of mercury oxide, partially combined chemically with oxide of nitrogen supported on water-insoluble alkaline earth metal salt. No. 2,437,148. Arthur Livingston Barney to E. I. du Pont de Nemours & Company.

Dodecylamine salt of 2-mercaptobenzothiazole and process for making. No. 2,437,170. Arthur Minish to Nuodex Products Co., Inc.

Separation of diolefin from gaseous hydrocarbon mixture containing diolefin and more saturated hydrocarbon containing same number of carbon atoms. No. 2,437,230. Rupert C. Morris and Theodore W. Evans to Shell Development Company.

Isoprene ester of acid selected from plant hormone acids. No. 2,437,258. Franklin D. Jones to American Chemical Paint Company.

Condensation products of cholesteryl esters with polyethylene glycol and process for producing same. No. 2,437,261. Louis L. Lerner to Consolidated Royal Chemical Corporation.

Manufacture of alkali metal methylates. No. 2,437,272. Richard Sewall Robinson to Allied Chemical & Dye Corporation.

Preparation of erythritol comprises hydrolyzing dichloro diacetate of butadiene in presence of 5 to 25% aqueous solution of weak alkali at 110° to 140° C. No. 2,437,277. Frank J. Soday to United Gas Improvement Company.

Compound containing a four-carbon atom ring to which is attached directly cyano group, plurality of fluorine atoms, and tervalent nitrogen atom having at least one and not more than two valences attached directly to carbon atom of said ring. No. 2,437,289. Paul L. Barrick to E. I. du Pont de Nemours & Company.

Fluorohydrocarbons by reacting hydrogen fluoride with acetylenic hydrocarbons. No. 2,437,307. Leroy Frank Salisbury to E. I. du Pont de Nemours & Company.

Obtaining 2-fluoro-1, 3-butadiene, step of passing mixture of monovinylacetylene and hydrogen fluoride over charcoal impregnated with mercuric oxide. No. 2,437,308. Leroy Frank Salisbury to E. I. du Pont de Nemours & Company.

2-chloroethylcyclopropyl ether and method of preparing it. No. 2,437,368. Robert M. Vance and Amos G. Horney to Air Reduction Company, Inc.

Para-tertiary amino phenyl aldehydes. No. 2,437,370. Cyril D. Wilson to E. I. du Pont de Nemours & Company.

Making 2-oxazolidones which are substituted in 3-position. No. 2,437,388. August H. Homeyer to Mallinckrodt Chemical Works.

Oxazolidones and process for making same. No. 2,437,389. August H. Homeyer to Mallinckrodt Chemical Works.

2-oxazolidone compounds and process for preparing same. No. 2,437,390. August H. Homeyer to Mallinkrodt Chemical Works.

Manufacture of alphachloro-beta-hydroxy propionic acid. No. 2,437,410. Karl Heinrich Walter Tuerck and Hans Joachim Lichtenstein to The Distillers Company, Limited.

Aromatic mercury alcoholates. No. 2,437,450. Carl N. Andersen to Gallowhur Chemical Corporation.

Cyclohexanol selected from rosin- and rosin ester-cyclohexanols. No. 2,437,481. Alfred L. Rummelsburg to Hercules Powder Company.

Manufacture of anhydrous aliphatic acids from aqueous solutions thereof. No. 2,437,519. Henri Martin Guinot and Pierre Chassaing to Les Usines De Melle (societe Anonyme).

Basic amides of 1-aryl-cycloalkyl-1-carboxylic acids. No. 2,437,545. Henry Martin and Franz Hafliger to J. R. Geigy A.-G.

Manufacture of 21-oxy-compounds of pregnane series wherein pregnane compounds, which contain between carbon atoms 20 and 21 ethylene bond and on carbon atom 17 hydroxyl group, are converted with aid of agents adding on any oxygen-containing group, followed by hydrolysis, into compounds of glycerol-like structure. Series 2,437,564. Arthur Serini and Willy Logemann to Schering Corporation.

Preparing aldehydes which comprises reacting olefinic hydrocarbon with carbon monoxide and hydrogen. No. 2,437,600. William F. Gresham, Richard E. Brooks and Walter M. Bruner to E. I. du Pont de Nemours & Company.

Separating fatty acid soaps of black liquor soap from rosin acids by forming hot, substantially anhydrous solution of fatty acids, rosin acids and an amount of alkali to neutralize only fatty acids in alcoholic organic solvent, etc. No. 2,437,643. Alfred G. Houpt to American Cyanamid Company.

Direct production of polyhydroxy derivatives of unsaturated hydrocarbons containing at least one olefinic linkage. No. 2,437,648. Nicholas A. Milas to Research Corporation.

Separation of phenols from hydrocarbon distillates by steam distillation. No. 2,437,649. David William Milner to Yorkshire Tar Distillers Limited.

Pyrimidine compounds and processes for making. No. 2,437,682. Francis Henry Swinden Curd, Clifford Gordon Raison and Francis Leslie Rose to Imperial Chemical Industries Limited.

Pyrimidine compounds and method of producing. No. 2,437,683. Francis Henry Swinden Curd, Clifford Gordon Raison and Francis Leslie Rose to Imperial Chemical Industries Limited.

Manufacture of derivatives of 2:4-diamino-1:3:5-triazines. No. 2,437,691. Adolf Grün to J. R. Geigy A. G.

Simultaneously hydrobleaching and hardening glyceride oils. No. 2,437,705. William J. Paterson to Lever Brothers Co.

Hydrobleaching glyceride oils. No. 2,437,706. William J. Paterson to Lever Brothers Company.

Production of resins from methylol monohydric phenol and polydydric phenol. No. 2,437,710. Philip Hamilton Rhodes to Koppers Company, Inc

Beta-cyclohexylaminoethyl benzhydryl ether and salts. No. 2,437,711. George Rieverschl, Jr. to Parke, Davis & Company.

Benzoic acid di-cis-2-(4'-carboxybutyl)-3:4-diamino-tetrahydrothiophene sulfate complex. No. 2,437,719. Donald E. Wolf and Anthony C. Shabica, Jr. to Merck & Co., Inc.

Process of stabilizing fats, fatty acids, fatty acid derivatives and oils of animal and vegetable origin against oxidative deterioration. No. 2,437,731. Lucius W. Elder and Harold S. Levenson to General Foods Corporation.

Pyrolyzing alpha-pinene to alloocimene in liquid phase. No. 2,437,759. Theodore R. Savich and Leo A. Goldblatt.

Production of diolefin of four to five carbon atoms per molecule from olefins of two to five carbon atoms per molecule. No. 2,437,773. Thomas H. Whaley to Phillips Petroleum Company.

Making organic phosphines. No. 2,437,795. Cheves Walling to E. I. du Pont de Nemours & Company.

Making organic phosphorous halides. No. 2,437,796. Cheves Walling to E. I. du Pont de Nemours & Company.

New metal salts of organic phosphines and processes of making. No. 2,437,797. Cheves Walling to E. I. du Pont de Nemours & Company.

Di-n-butyl bromo phosphine. No. 2,437,798. Cheves Walling to E. I. du Pont de Nemours & Company.

Alkylating benzene hydrocarbons with olefins in which water is utilized to dilute sulphuric acid present during reaction below sulphonating strength. No. 2,437,828. Daniel J. Lyons, Arthur Lazar and Lloyd L. Ingraham to Tide Water Associated Oil Company.

New class of compound N-myristyl-N-benzyl morpholinium halides. No. 2,437,833. Joseph B. Niederl and Victor Niederl and Martin E. McGreal.

Separating diacetone and monoacetone sorbose. No. 2,437,852. William R. Graff and William S. Harmon to Merck & Co., Inc.

Preparation of dihydroxanthopterin and xanthopterin. No. 2,437,853. George H. Hitchings to Burroughs Wellcome & Co. (U.S.A.), Inc.

Water-soluble unsaturated trihydric terpene alcohol. No. 2,437,857. Donald A. Lister to Hercules Powder Co.

Treating diacetone sorbose and monoacetone sorbose. No. 2,437,858. John F. Mahoney and Henry H. Bassford, Jr., to Merck & Co., Inc.

New chemical compound, 1-chloro-3-bromo-2-(2-chloroethoxy)-propane. No. 2,437,866. Robert M. Vance and Amos G. Horney to Air Reduction Company, Incorporated.

Additional patents from the above volumes will be given next month.

Trademarks of the Month

A Checklist of Chemical and Chemical Specialties Trademarks

326,946. Registered Aug. 13, 1935. Monsanto Chemical Co., St. Louis, Mo.; corp. of Del.; Republished by registrant; for insecticides, etc.; since Apr. 4, 1935.

339,562. Registered Oct. 13, 1936. I. F. Laucks, Inc., Seattle, Wash. Republished by Monsanto Chemical Company, St. Louis, Mo.; for synthetic resins; since Mar. 7, 1936.

436,845. Dominion Chemical Co., Inc., New York, N. Y.; filed Jan. 19, 1946; Serial No. 495,017; for liquid compound to prevent corrosion and formation of rust; since July, 1936.

499,869. U. S. Industrial Chemicals, Inc., New York, N. Y.; filed Apr. 8, 1946; for organosilicon compounds; since Mar. 27, 1946.

499,875. The Upco Co., Cleveland, Ohio; Ohio; filed Apr. 8, 1946; for liquid coating resistant to acid and alkali; since Jan., 1945.

504,689. Penola, Inc., Chicago, Ill.; filed June 27, 1946; for petroleum oils; since Feb. 26, 1946.

505,119. National Wax Company, Chicago, Ill.; filed July 5, 1946; for wetting agent used in defeathering fowls; since June 17, 1946.

507,849. The Resinous Products & Chemical Company, Philadelphia, Pa.; filed Aug. 22, 1946; for synthetic resinous materials; since Nov. 2, 1940.

508,523. Illinois Agricultural Association, Chicago, Ill.; filed Sept. 5, 1946; for insecticides, etc.; since 1930.

509,029. Perinol Products Co., Inc., New York, N. Y.; filed Sept. 13, 1946; for mineral adhesive waterproofing surfacing material; since Feb. 19, 1946.

511,079. General Dyestuff Corporation, New York, N. Y.; filed July 10, 1947; for emulsifying agents; since Aug. 30, 1946.

511,799. Detergents, Inc., Columbus, Ohio; filed Oct. 31, 1946; for detergents; since Sept. 29, 1946.

512,102. Alton Laboratories, Inc., Chicago, Ill.; filed Nov. 6, 1946; for ready mixed paints; since July 1, 1946.

512,474. Ziebarth Corporation, Seattle, Wash.; filed Nov. 12, 1946; for bleaching compound; since Sept. 1, 1946.

514,528. The Diversey Corporation, Chicago, Ill.; filed July 19, 1947; for insecticide; since Nov. 26, 1946.

514,617. Monsanto Chemical Company, St. Louis, Mo.; filed July 12, 1947; for fire-repellent composition containing phosphates for textiles; since Oct. 29, 1946.

515,204. Susquehanna Chemical Corporation, Bradford, Pa.; filed Jan. 2, 1947; for methanol; since Oct. 19, 1946.

515,508. Michigan Chemical Corporation, St. Louis, Mich.; filed Jan. 9, 1947; for chemical fire extinguishing composition; since Nov. 29, 1946.

515,957. Lystad & Redick, Inc., East Grand Forks, Mich.; filed Jan. 18, 1947; for cleaning, cleansing, and detergent compound; since Feb. 26, 1942.

516,485. Inertol Co., Inc., Newark, N. J.; filed Jan. 28, 1947; concrete and steel coatings; since July 7, 1926.

516,885. Atlas Powder Co., Wilmington, Del.; filed July 19, 1947; stabilizers for starches and emulsifying and wetting agents; since Jan. 7, 1947.

518,288. Fibre Cord Division of Kary-Safe Paper Bag Co., Inc., New York, N. Y.; filed Feb. 28, 1947; for rayon and cellophane ribbon; since Aug., 1946.

519,483. Monsanto Chemical Company, St. Louis, Mo.; filed July 28, 1947; for insecticides, etc.; since Feb. 7, 1947.

520,766. Preventive Maintenance Company, Bridgeport, Conn.; filed Apr. 15, 1947; for wax and soap base lubricants; since Feb. 8, 1946.

524,491. Societe de Products Chimiques des Terres Rares, Paris, France; filed June 19, 1947; for chemical preparations for degreasing metals, etc.; since May 31, 1946.

524,582. United States Gasket Company, Camden, N. J.; filed June 20, 1947; for plastic jacketed gaskets; since Oct. 10, 1946.

525,296. Chemicolloid Laboratories, Inc., New York, N. Y., filed July 1, 1947; for colloid mills; since Mar. 26, 1925.

526,875. Mallinckrodt Chemical Works, St. Louis, Mo.; filed July 5, 1947; for powdered insecticides; since Apr., 1935.

527,602. Minnesota Linseed Oil Paint Co., Minneapolis, Minn.; filed July 5, 1947; for paint ready for use; since Sept. 25, 1931.

527,825. National Lead Company, New York, N. Y.; filed July 5, 1947; for soldering flux; since Oct. 31, 1945.

528,789. The C. P. Hall Company, Akron, Ohio; filed July 17, 1947; for plasticizer, tackifier, and extender for rubbers; since Mar. 11, 1943.

528,948. Crop-Saver Chemical Company, Inc., Chicago, Ill.; filed July 19, 1947; for insecticides; since Mar. 2, 1939.

529,261. The C. P. Hall Company, Akron, Ohio; filed July 23, 1947; for plasticizer and extender for rubber and synthetic rubbers; since Apr. 19, 1939.

530,265. The Valentine Company, Seattle, Wash.; filed Aug. 1, 1947; for chemical compounds for industrial cleaning purposes; since Nov. 1, 1924.

530,703. American Cyanamid Company, New York, N. Y.; filed Aug. 7, 1947; for charcoal precipitants; since Feb. 19, 1947.

530,727. Dunlop Tire and Rubber Corp.; Buffalo, N. Y.; filed Aug. 7, 1947; for rubber solvent; since Aug. 5, 1946.

531,226. Lion Chemical Company, Chicago, Ill.; filed Aug. 13, 1947; for antifreeze; since Aug. 6, 1946.

531,400. West Disinfecting Company, Long Island City, N. Y.; filed Aug. 14, 1947; for insecticide; since May 15, 1947.

532,367. Stauffer Chemical Company, San Francisco, Calif.; filed Aug. 25, 1947; for sulphur; since June 12, 1917.

532,370. Stauffer Chemical Company, San Francisco, Calif.; filed Aug. 25, 1947; for sulphur; since May 14, 1924.

534,430. Geigy Company, Inc., New York, N. Y.; filed Sept. 13, 1947; for insecticides; since June 30, 1947.

534,474. Röhm & Haas Company, Philadelphia, Pa.; filed Sept. 13, 1947; for powdered synthetic resins; since May 6, 1947.

535,363. American Cyanamid Company, New York, N. Y.; filed Sept. 23, 1947; for parathion; since Sept. 15, 1947.

536,736. Vis-ko, Inc., Sumner, Wash.; filed Oct. 3, 1947; for insecticides and fungicides; since Aug. 4, 1937.

538,583. Oronite Chemical Co., Wilmington, Del., and San Francisco, Calif.; filed Nov. 28, 1947; for cleaning compounds; since Sept. 19, 1947.

SANTOPHEN 326,946

508,523

DIVOBAN 514,528

RAY-TRIM 518,288

SYN-TAC 528,789

HYDROSECT 531,400

LAUXITE 339,562

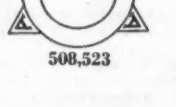
REZGARD 514,617

BIOQUIN 519,483

-KROP-SAVER 528,948

TRIANGLE 532,367

RUSTOFF 436,845


509,029

SUSQUEHANNA CHEMICALS 515,204

Rubber Flo 520,766

PARA RESIN 529,261

YELLOTONE 532,370

AROSIL 499,869

EMULPHOGENE 511,079

FRAMANOL 524,491

VALCO 530,265

GY-PHENE 534,430

ANTACIDOL 499,975

all 511,799

CB 515,508

CHEMISEAL 524,582

CHARLOTTE 525,296

AEROCHAR 530,703

RHONITE 534,474

504,689

san-finish 512,102

CIRCLE SUDS 515,957

526,875

3422 535,363

GOLD CUP 530,727

FETHERWET 505,119

INERTOL 516,485

COSMOPOLITAN 527,602

VIS-KO 536,736

AMBERLITE 507,849

Z BAR 512,474

MERJ 516,885

NALCO 527,825

GASONE 531,226

PETRODET 538,583

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Technical Information Manual LTF-1 . . . Lead-Tin Alloy Plating from the Fluoborate Bath.

Technical Information Manual CF-1 . . . Copper Fluoborate.

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